SPECIALIZED TECHNOLOGIES
FOR INDUSTRIAL SUPPLIES CO. LTD
Limited Liability Company
PAID UP CAPITAL: SR 500 000

شركـة التقنيات المتخصصة
للـتجهيـزات الـصناعية الـمحـدودة
شركة ذات مسئولية محدودة
رأس المال المدفوع:

PROJECT

PURCHASE & INSTALL WEATHER MONITORING STATIONS

CONTRACT # 30531212/00

P.O. Box 31501, Al- Khobar 31952 – Saudi Arabia - Tel: (+966 3)8147147-Fax: (+966 3)8147149 – C.R.2051025629, Email: sales@stisco.com – Website: www.stisco.com

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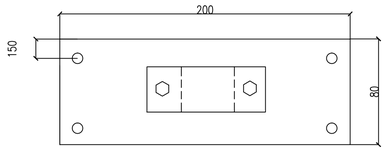
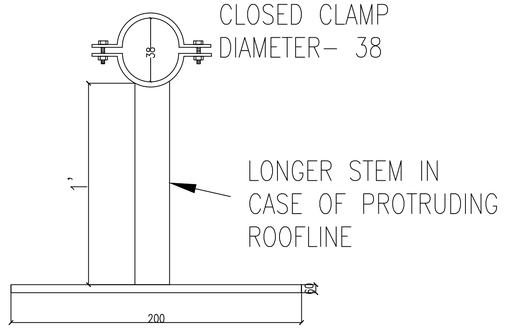
I - DRAWINGS

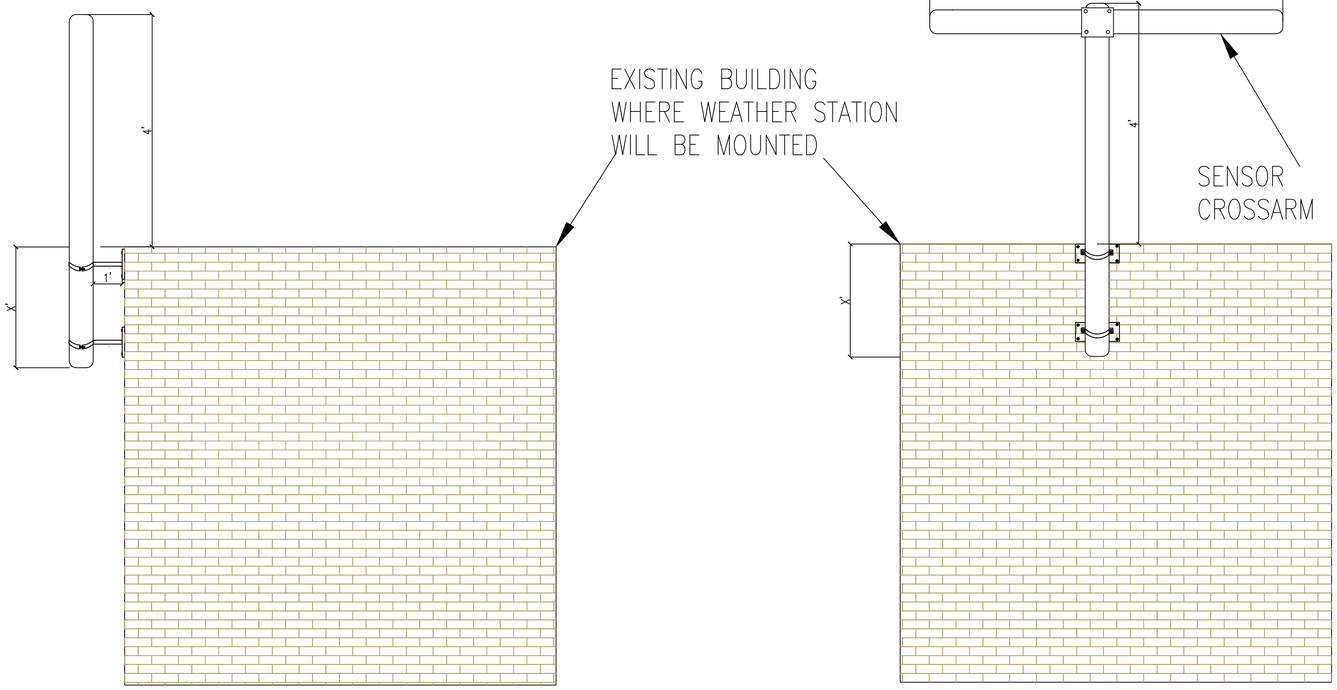
JOB ORDER N0.	INDEX	PLANT NO.	DRAWING NUMBER	SHEET NO.	REV NO.
	T	XXXX	EA-194318	01 OF 01	00

POLE MOUNT BRACKET DETAILS





TYPICAL INSTALLATION



NOTES

1. ALL MEASUREMENTS ARE IN MM AND FEET.
2. DISTANCE OF POLE BELOW ROOFLINE "X'" WILL BE DETERMINED ON A PER SITE BASIS.
3. THE CLAMP WITH THE LONGER STEM WILL BE USED AT LOCATIONS WHICH HAVE A PROTRUDING ROOF.

LEGEND

DRAWING REFERENCE

DRAWING TITLE	DRAWING NO.

Specialized Technologies for Industrial Supplies CO., LTD
P.O. BOX 31501, Al-Khobar 31952 - Saudi Arabia
Tel: (+966 3) 814-7147 - Fax: (+966 3) 814-7149
C.R. 2051025629, Email: sales@stisco.com
Web site: http://www.stisco.com

DESIGNED BY. STISCO DATE: XX XX XXXX

DRAWN BY: ___ CHKD BY___ SCALE: N.TS
DATE STARTED 2011-11-24 DATE COMPLETED 2011-11-26
OPR'G DEPT. _____ ENG.DEPT. _____.

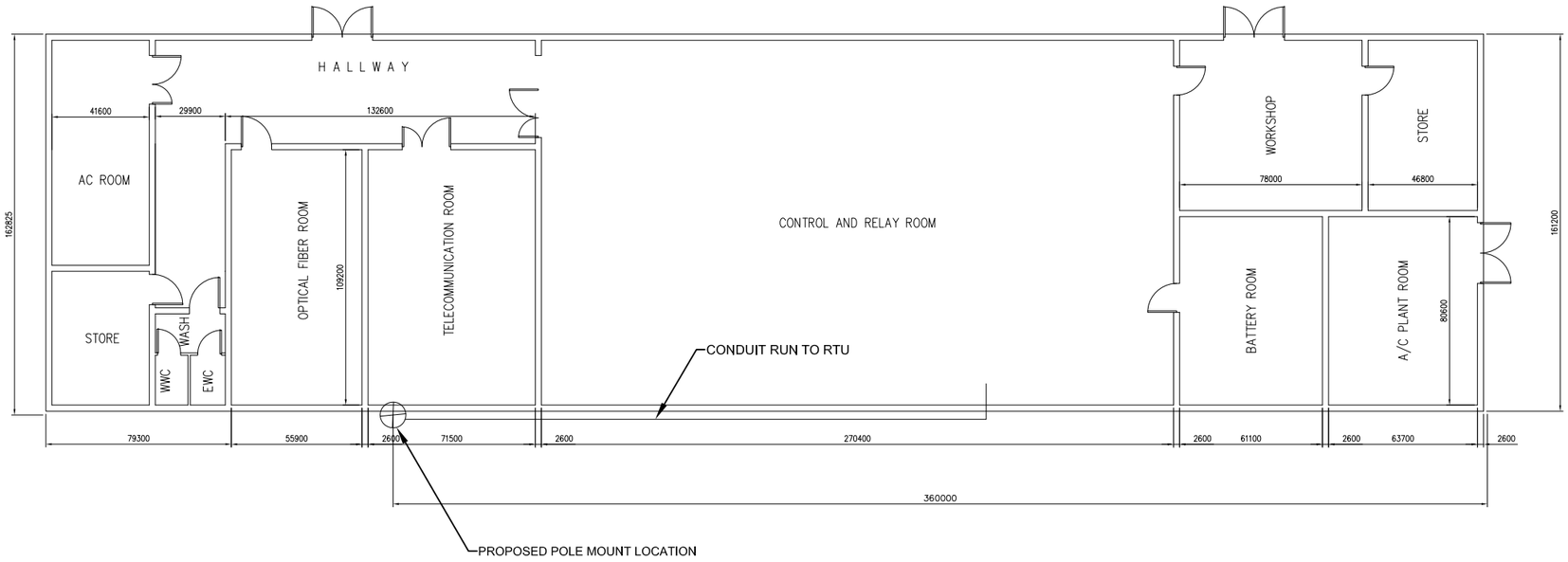
POLE MOUNT BRACKET / INSTALLATION DETAILS

PURCHASE AND INSTALL WEATHER MONITORING STATIONS

TYPICAL INSTALLATION

JOB ORDER N0.	INDEX	PLANT NO.	DRAWING NUMBER	SHEET NO.	REV NO.
	T	XXXX	EA-194318	01 OF 01	00

JOB ORDER NO.	INDEX	PLANT NO.	DRAWING NUMBER	SHEET NO.	REV. NO.
XXXXXX	T	9003	KA-XXXXXX	01 of 01	00



NOTES

1. ALL DIMENSIONS ARE IN MILLIMETERS (mm) & ALL LEVELS ARE IN METERS UNLESS OTHERWISE NOTED.
2. CONDUIT WILL RUN ALONG ROOFLINE AND ENTER THE CONTROL & AND RELAY ROOM.
3. BRACKETS USED TO MOUNT THE POLE WILL ACCOUNT FOR THE PROTRUSION OF THE ROOFLINE.

LEGEND

⊕ PROPOSED POLE MOUNT LOCATION

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NO.
DRAWING CONTROL SHEET	KE-655901

GRAPHIC SCALE: 0 0.5 1 2 3 4 5 6 7 8 9 10m
SCALE : 1 : 100

AS-BUILT BY ABB CONTRACTING CO. LTD. DATE 2007-05-30

REV. NO.	DATE	BY	DESCRIPTION	CHKD.	CERT.	APPD.

الشركة السعودية للكهرباء
Saudi Electricity Company

DRAWN BY SF CHECKED BY SF SCALE: 1 : 100
DATE STARTED 2012-02-20 DATE COMPLETED 2012-02-20
OPR'G. DEPT. _____ ENG. DEPT. _____

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CERTIFIED BY _____ DATE _____

PROPOSED POLE MOUNT LOCATION LAYOUT
WEATHER MONITORING STATION
SUBSTATION 9003 LAYOUT
AL KHARJ SAUDI ARABIA

JOB ORDER NO.	INDEX	PLANT NO.	DRAWING NUMBER	SHEET NO.	REV. NO.
	T	9003	KA-XXXXX	01 of 01	00

SEC-ERB CAD-A (2004/03)
DMS VECTOR Cadd03

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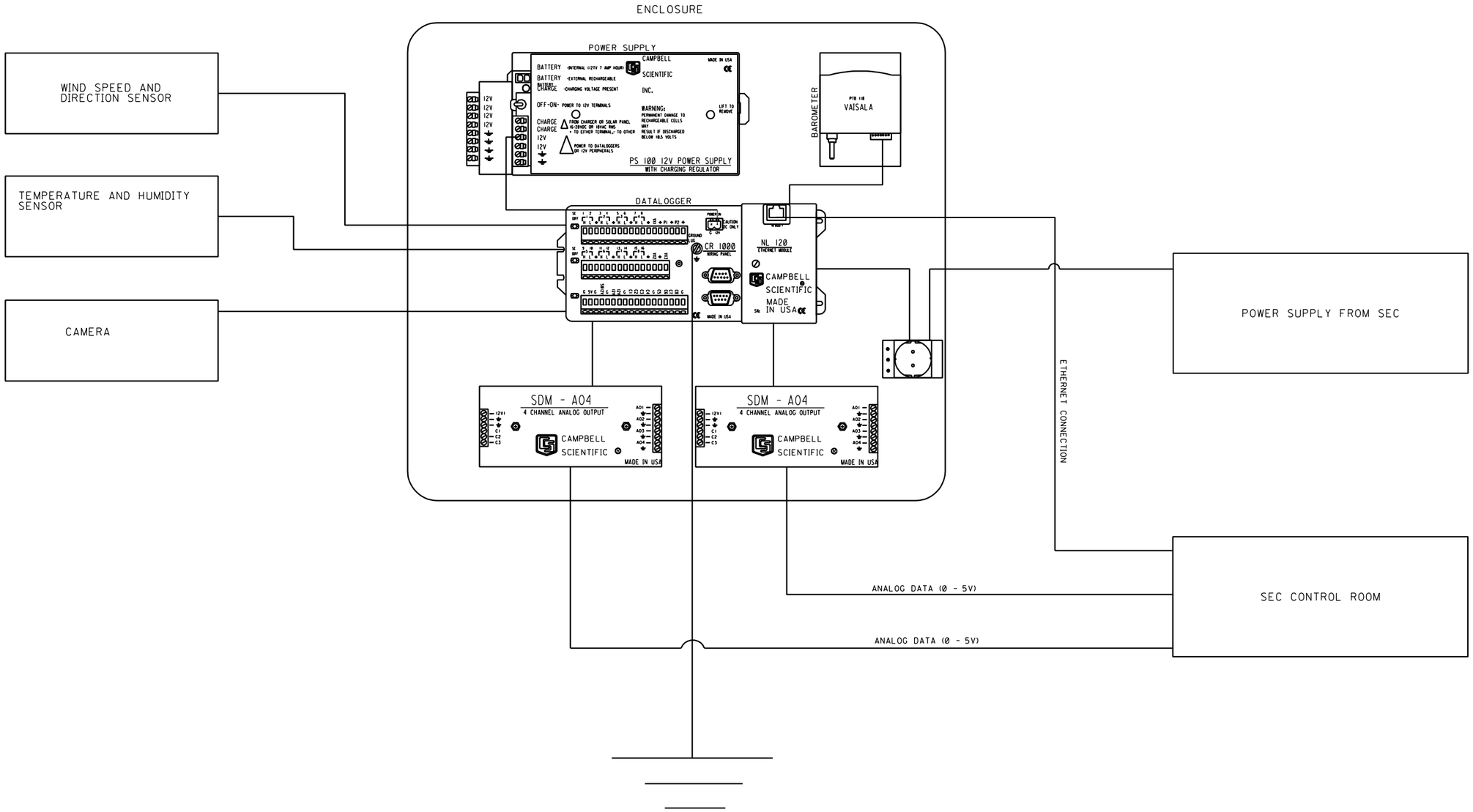

NOTES

1. ANALOG DATA (0 - 5V): REPRESENTS THE VOLTAGE EQUIVALENT OF THE TEMPERATE, HUMIDITY, PRESSURE WIND SPEED AND DIRECTION.
2. ETHERNET CONNECTION: CONNECTS THE DATALOGGER TO THE LOGGERNET SOFTWARE.

LEGEND

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NO.
DRAWING CONTROL SHEET	KE-479655
	-
	-
	-
	-
	-
	-

AS-BUILT BY STISCO DATE 2011-04-25

REV. NO.	DATE	BY	DESCRIPTION	CHKD.	CERT.	APPD.

الشركة السعودية للكهرباء
Saudi Electricity Company

DRAWN BY MOH CHECKED BY MBM SCALE: NONE
DATE STARTED 2011-04-22 DATE COMPLETED 2011-04-24
OPR'G. DEPT. ENG. DEPT.

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CERTIFIED
BY DATE

SINGLE LINE WIRING DIAGRAM
WEATHER MONITORING STATIONS ENCLOSURE
TYPICAL ENCLOSURE WIRING
AL KHARJ SAUDI ARABIA

JOB ORDER NO.	INDEX	PLANT NO.	DRAWING NUMBER	SHEET NO.	REV. NO.
XXXXXXXX	P	9003	EA-194314	01 of 01	00

SEC-A (2004/10)
DMS VECTOR SECA00

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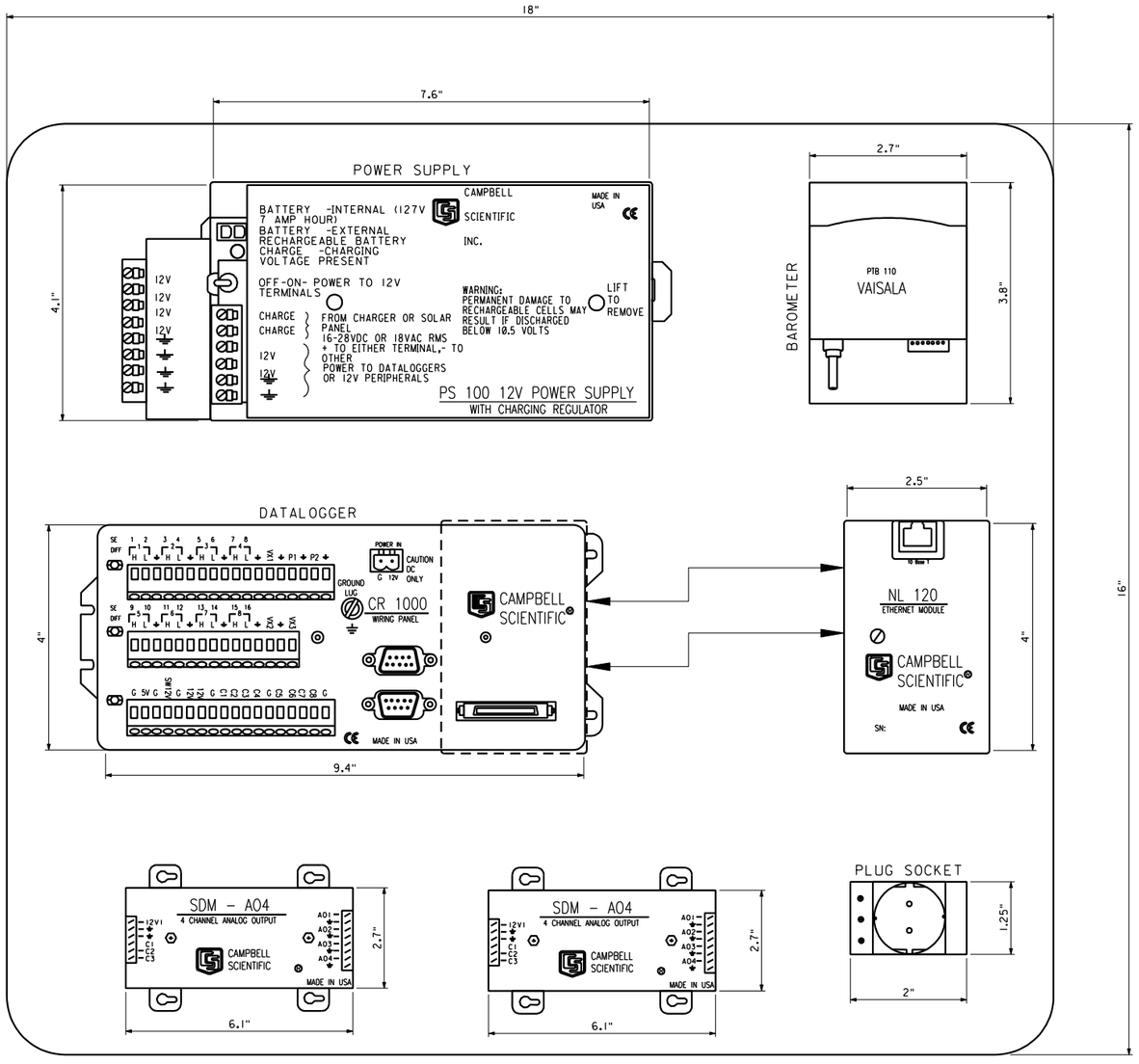

ENCLOSURE DETAILS

NOTES

LEGEND

FOC	- FIBER OPTIC CABLE
3C	-3 CORE
6A	-6 AMPERE

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NO.
DRAWING CONTROL SHEET	KE-479655
	-
	-
	-
	-
	-
	-

AS-BUILT BY STISCO DATE 2011-04-25

REV. NO.	DATE	BY	DESCRIPTION	CHKD.	CERT.	APPD.

الشركة السعودية للكهرباء
Saudi Electricity Company

DRAWN BY MOH CHECKED BY MBM SCALE: NONE
DATE STARTED 2011-04-22 DATE COMPLETED 2011-04-24
OPR'G. DEPT. ENG. DEPT.

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CERTIFIED BY DATE

DETAILS-LOCATION-TYPICAL WEATHER MONITORING STATIONS ENCLOSURE

TYPICAL ENCLOSURE WIRING

AL KHARJ SAUDI ARABIA

JOB ORDER NO.	INDEX	PLANT NO.	DRAWING NUMBER	SHEET NO.	REV. NO.
XXXXXXXX	T	9003	EA-194313	01 of 01	00

SEC-A (2004/10)
DMS VECTOR SECA00

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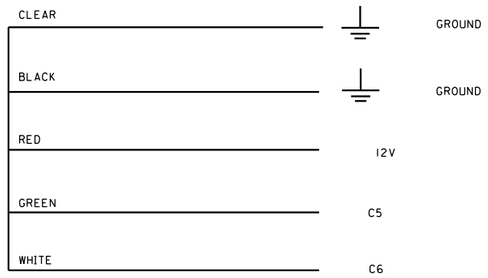
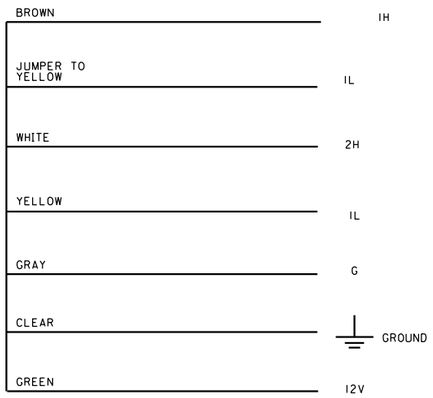
XXXXXXXX	P		EA-194316	01 of 01	00

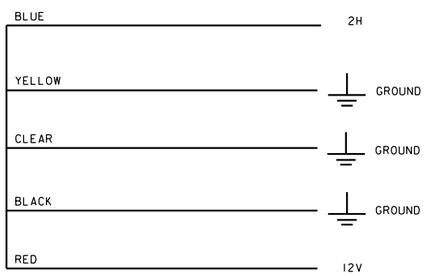
WINDSONIC I



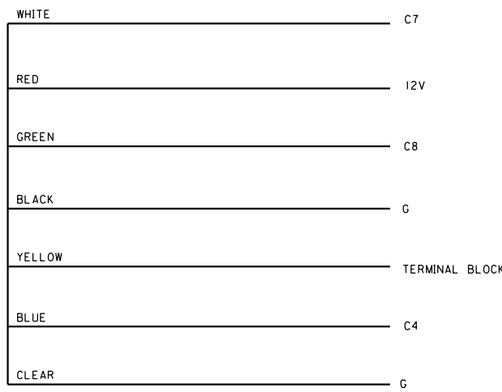
HC2S3



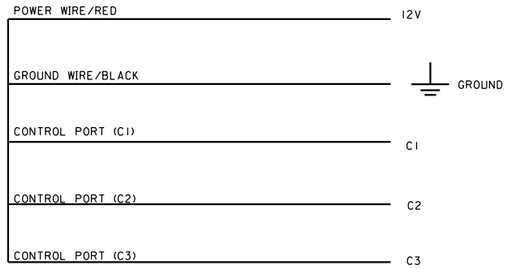
CS106



CC5MPX



SDM-A04A (x2)



NOTES

LEGEND

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NO.
DRAWING CONTROL SHEET	KE-479655
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	-
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	-

AS-BUILT BY STISCO DATE 2011-04-25

REV. NO.	DATE	BY	DESCRIPTION	CHK'D.	CERT.	APP'D.

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Saudi Electricity Company

DRAWN BY MDH CHECKED BY MBM SCALE: NONE
DATE STARTED 2011-04-22 DATE COMPLETED 2011-04-24
OPR'G. DEPT. ENG. DEPT.

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CERTIFIED BY DATE

WEATHER MONITORING STATIONS WIRING DIAGRAM (TYPICAL)

WEATHER MONITORING STATIONS

TYPICAL ENCLOSURE WIRING

AL KHARJ SAUDI ARABIA

JOB ORDER NO.	INDEX	PLANT NO.	DRAWING NUMBER	SHEET NO.	REV. NO.
XXXXXXXX	P	9003	EA-194316	01 of 01	00

SEC-A (2004/10)
DMS VECTOR SECA00

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II - MOUNTING OPTIONS

MOUNTING OPTIONS

The Weather Monitoring Stations that are being installed provide the flexibility of being mounted in several ways. Mounting can be done via a 10m Tower, a Tripod or most conveniently by Pole mount.

Unlike the Tower and Tripod installations the Pole mount is light in weight, requires no excavation or underground cable laying and no modifications to existing Plant. The Pole mount installation consists of a pole mounted via application specific brackets to a predetermined wall. Such an installation will be beneficial for installation and future maintenance purposes. Custom designed brackets fabricated from galvanized steel will guarantee long life and minimum maintenance. These heavy duty brackets are capable of sustaining weights many times the weight of the installation. Furthermore, the installation footprint on the existing substation building and surroundings is minimal.

Below pictures illustrate the type of bracket(s) that will be utilized.

III - DATASHEETS

WEATHER MONITORING STATION (POLE MOUNTED) - EQUIPMENT WEIGHT					
NO.	MODEL NO.	ITEM DESCRIPTION	QTY	WEIGHT (g)	TOTAL (g)
1	N/A	PLUG SOCKET WITH DIN RAIL	1	260	260
2	CS106	BAROMETER/PRESSURE SENSOR	1	90	90
3	NL120	ETHERNET INTERFACE UNIT	1	66.6	66.6
4	SDM-AO4A	ANALOG OUTPUT (VOLTAGE) CARD	2	408	816
5	CR1000	DATALOGGER WITH MOUNTING KIT	1	1050	1050
6	PS100	POWER SUPPLY/BATTERY	1	3100	3100
7	WindSonic1	WIND SPEED AND DIRECTION SENSOR	1	500	500
8	HC2S3	TEMPERATURE AND HUMIDITY SENSOR WITH SHIELD	1	600	600
9	CM206	CROSSARM FOR SENSORS	1	2270	2270
10	CC5MPX	CAMERA	1	1060	1060
11	14014	WALL CHARGER	1	454	454
12	ENC16/18	ENCLOSURE	1	7700	7700
13	N/A	RAIL AND U CLAMPS (FOR MOUNTING ENCLOSURE)	LOT	2500	2500
14	N/A	DESICCANT	2	600	1200
15	N/A	CABLES	LOT	5500	5500
16	N/A	POLE MOUNT WITH BRACKETS	1	10000	10000
		TOTAL WEIGHT OF POLE MOUNT INSTALLATION - 37 kg			

ENC-Series

Weather-Resistant Enclosures

Campbell Scientific offers fiberglass-reinforced polyester enclosures for housing our dataloggers and peripherals. These non-corrosive, white enclosures are UV-stabilized and reflect solar radiation—reducing temperature gradients inside the enclosure without requiring a separate radiation shield. Dataloggers and peripherals housed in an enclosure with desiccant are protected from water and most pollutants.

The NEMA 4X enclosures (modified for cable entry) include a door gasket, external grounding lug, stainless steel hinge, and a lockable hasps. The enclosures are shipped with the 7363 enclosure supply kit that consists of desiccant, a humidity indicator card, cable ties, wire tie tabs, putty, grommets, screws, and PVC coupling. Additionally, Campbell Scientific offers a CS210 Enclosure Humidity Sensor for monitoring relative humidity inside of the enclosure.

Backplate

Dataloggers, peripherals, and brackets are mounted to an internal plate punched with a grid of one-inch-on-center holes. This mounting scheme simplifies system configuration and facilitates addition and removal of equipment in the field.

An internal backplate is included with each ENC10/12, ENC12/14, or ENC14/16 enclosure. Two internal mounting plate options are offered for the ENC16/18. The *-SB* option provides a backplate that is similar to the one included with the other enclosures. The *-EB* option provides both a backplate and sideplate. Photograph at right shows an ENC16/18 with the *-EB* option.

Models Available

ENC10/12

Campbell Scientific's ENC10/12 enclosure has internal dimensions of 10 x 12 x 4.5 in. (25.4 x 30.5 x 11.4 cm) and weighs 9.0 lb. (4.1 kg). It can house one CR200(X)-series datalogger, power supply, and one small peripheral. A CR800, CR850, or CR1000 can also be housed in the ENC10/12 if the #17565 stack mounting kit is used. For peripherals that are taller, an enclosure that has a raised lid is available; contact Campbell Scientific for more information.

ENC12/14

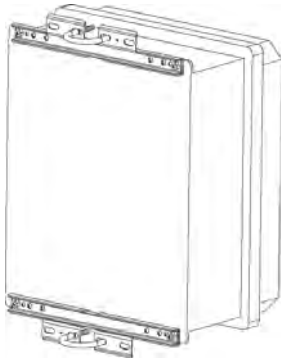
The ENC12/14 has internal dimensions of 12 x 14 x 5.5 in (30.5 x 35.6 x 14 cm). This enclosure can house one CR200(X)-series, CR800, CR850, CR1000, or CR3000 datalogger, power supply, and one or more peripherals (depending on the peripheral's footprint). It weighs 11.2 lb. (5 kg).

ENC14/16

This enclosure has internal dimensions of 14 x 16 x 5.5 in. (35.6 x 40.6 x 14 cm). The ENC14/16 can house one CR200(X)-series, CR800, CR850, CR1000, CR3000, or CR5000 datalogger, power supply, and one or more peripherals (depending on the peripheral's footprint).

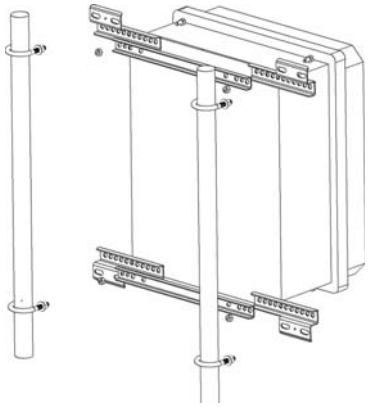
ENC16/18

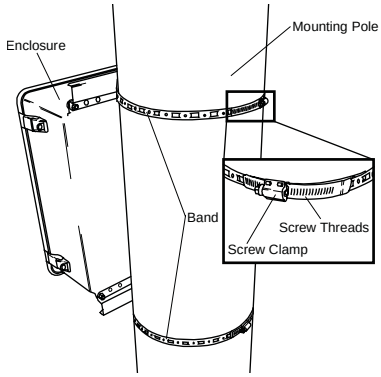
The ENC16/18, our largest enclosure, provides internal dimensions of 16 x 18 x 9 in (40.6 x 45.7 x 22.9 cm) and weighs 17 lb. (7.7 kg). It can house one CR200(X)-series, CR800, CR850, CR1000, CR3000, or CR5000 datalogger, power supply, and two or more peripherals (depending on the peripheral's footprint).



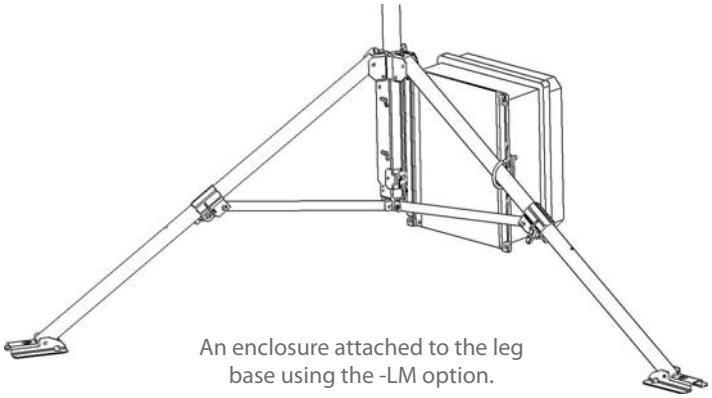
At left is an enclosure with the *-MM* mount option. The bracket is ready to be attached to a mast or user-supplied vertical pipe with a 1.25-in. to 2.1-in. outer diameter.

At right is an exploded view of the -TM option. It shows the bracket components and how the enclosure attaches to a tower.





At left shows the -PM option, where the enclosure is mounted to a large diameter pole via band clamps.



An enclosure attached to the leg base using the -LM option.

Mounting Bracket Options

Tripod

Order the *-MM* option if you want to mount your enclosure to the mast of one of our tripods or to a user-supplied pipe with a 1.25-in to 2.1-in OD. A three-piece bracket attaches to the top of the enclosure and an identical three-piece bracket attaches to the bottom of the enclosure (see illustrations at right). Each bracket is attached to the mast or pole via a 2-in u-bolt.

Tower

Order the *-TM* option if you want to mount your enclosure to a UT10, UT20, or UT30 tower. This mounting bracket option uses the same three-piece brackets as the *-MM* option, except the pieces are rearranged so that the flanges are on the side of the bracket instead of in the middle. Four 1.5-in u-bolts attach the brackets to the tower legs.

Please note that enclosures with the *-TM* option are shipped configured for the UT10 tower. UT20 and UT30 customers will need to: (1) remove the bolts attaching the bracket to the enclosure, (2) slide out the flange sections so that the distance between the center of each flange is 17 inches, and (3) reattach the bracket to the enclosure using the original bolts.

Tripod Leg Base

Order the *-LM* option to mount the enclosure to the leg base of a CM106, CM110, CM115, or CM120 tripod; the ENC16/18 can only be mounted to the CM106's leg base. This option includes a metal flange, two brackets, and a 2.5-in u-bolt. The brackets attach to the right and left side of the enclosure, and the flange attaches to the tripod near the mast. The flange fits into a notch in one of the brackets, and the other bracket connects to a tripod leg via the u-bolt. Two enclosures may be mounted back-to-back on a leg base.

Large Diameter Pole

Order the *-PM* option to mount the enclosure to a large diameter pole such as a telephone pole. This option uses band clamps to secure the enclosure to the pole.

Special Brackets

Special brackets are also available for attaching enclosures to CTS Towers, Rohn Towers, Aluma Towers, or other non-Campbell Scientific instrument mounts. Contact Campbell Scientific for more information.

Cable-Entry Options

Conduit(s)

Multiple cables can be routed through one conduit. The *-SC* option provides one 1.5-in. diameter conduit; the *-DC* option provides two horizontally-arranged 1.5-in. diameter conduits; and the -VC option (ENC16/18 only) provides two vertically-arranged 1.5-in. diameter conduits. A plug included in the 7363 enclosure supply kit can reduce the conduit's internal diameter to 0.5 in. (1.3 cm). The enclosure supply kit also contains the putty used to seal each conduit.

Entry Seals (-ES Option)

Entry seals have a more water-tight seal than the conduits. With the *-ES* option, each entry seal is compressed around one cable. The seals contain a small vent to equalize pressure with the atmosphere. The number and size of seals provided depends on the enclosure model (see below):

ENC10/12: **(1) Medium** (fits 0.231 to 0.394 in. cables)
(2) Small (fits 0.118 to 0.275 in. cables)

ENC12/14: **(2) Medium** (fits 0.231 to 0.394 in. cables)
(2) Small (fits 0.118. to 0.275 in. cables)

ENC14/16: **(2) Large** (fits 0.236 to 0.512 in. cables)
(2) Medium (fits 0.231 to 0.394 in. cables)
(2) Small (fits 0.118 to 0.275 in. cables)

ENC16/18: **(2) Large** (fits 0.236 to 0.512 in. cables)
(2) Medium (fits 0.231 to 0.394 in. cables)
(2) Small (fits 0.118 to 0.275 in. cables)

Accessory Installations

Antenna Cable/Bulkhead

These accessories are offered for enclosures that will house a cellular phone, satellite transmitter, or radio. When ordered, Campbell Scientific will punch a special bulkhead hole in the enclosure and install a 17-in. antenna cable. Available antenna cable/bulkhead accessories are:

19335: Type N-to-RPSMA Antenna Cable for our RF401-series spread spectrum radios or CR200(X)-series dataloggers

19334: Type N-to-SMA Antenna Cable for the RF450 radio or RavenXT-series cellular modems

19332: Type N-to-Type N Antenna Cable for the RF310-series radios, TX320 GOES satellite transmitter, or FGR-115 radios

19336: Type SMA-to-SMA Antenna Cable for the GPS device used with satellite transmitters

19333: Type N-to-TNC Antenna Cable for our Raven100-series or Redwing100-series digital cellular modems

An enclosure with the *-SC* option includes one 1.5-in diameter port for cable entry. Shown is an ENC16/18 housing a CR1000 datalogger, CH200 Regulator, and BP24 battery pack.

An enclosure with the *-DC* option includes two horizontally-arranged 1.5-in diameter ports for cable entry (shown above).

An ENC16/18 with the *-ES* option has two small, two medium, and two large cable entry seals.

The CD100 has a vacuum fluorescent display for responsive use through a very wide operating temperature range. It has a water and dust ingress protection rating of IP66 when installed.

When a CD295 DataView II is installed in an enclosure door, you can view real-time data in the field without opening the enclosure.

CD100 Mountable Display with Keypad

Specify #27814 to have Campbell Scientific install a CD100 in the enclosure door. The CD100 is an integrated keypad with display that mounts in an enclosure lid, which allows you to enter and view data without opening the enclosure. The CD100 provides the same operation and functionality as the CR1000KD, and is typically used with our CR800 and CR1000 dataloggers.

CD295 Data View II Display

Specify #18132 to have Campbell Scientific install a CD295 in the enclosure door. The CD295 is a two-line, 32-character LCD that is used with PakBus® dataloggers (i.e., CR200(X), CR800, CR850, CR1000, CR3000). When the CD295 is installed in an enclosure door, you can view real-time data on-site without opening the enclosure.

CD294 Data View Display

Specify #16737 to have Campbell Scientific install a CD294 in the enclosure door. The CD294 is a two-line, 32-character LCD that is used with mixed-array dataloggers (e.g., CR510, CR10X). When the CD294 is installed in an enclosure door, you can view real-time data on-site without opening the enclosure.

Enclosure Door Switch Indicator

Specify #18166 to have Campbell Scientific install an enclosure door switch indicator or specify #18165 to have the customer install the indicator. This small accessory monitors when the door of the enclosure is open. It consists of an actuator and a magnetic switch—one is located on the case side, the other on the door side of the enclosure. The switch is monitored with a control port on the datalogger.

On the ENC10/12 and ENC12/14, the actuator (above left) for the door switch indicator is attached to the enclosure case and the switch (above right) is attached to the enclosure door. For the other enclosures, the actuator is attached to the door and the switch is attached to the case.

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CC5MPX & CC5MPXWD

High Resolution Digital Network Cameras

CAMPBELL SCIENTIFIC®
WHEN MEASUREMENTS MATTER

The CC5MPX and CC5MPXWD are high-resolution digital cameras with video capabilities. They produce JPG images with a resolution of up to 5 megapixels, and shoot videos with a resolution of up to 720P. Power conserving modes allow the cameras to be used in remote battery-powered installations.

The CC5MPX and CC5MPXWD have several options for image acquisition and storage. Still images or videos can be taken based on an internal timer, motion detection, or a trigger from a PakBus device (datalogger or MD485). The images or videos can then be stored on an SD card, saved in a datalogger's memory, sent to a PC via email, or transmitted to an FTP server.

Designed to work in harsh environments, the cameras can operate at temperatures as low as -40°C and as high as 60°C. They have an integrated environmentally sealed enclosure that protects them from moisture and high-humidity. Additionally, the CC5MPXWD includes an window defroster that prevents and removes light frost and icing* from the camera's window.

The 18549 mounting bracket kit fastens the camera to a CM202, CM204, or CM206 crossarm. Curved notches in the bracket allow the camera to be aimed at the desired target.

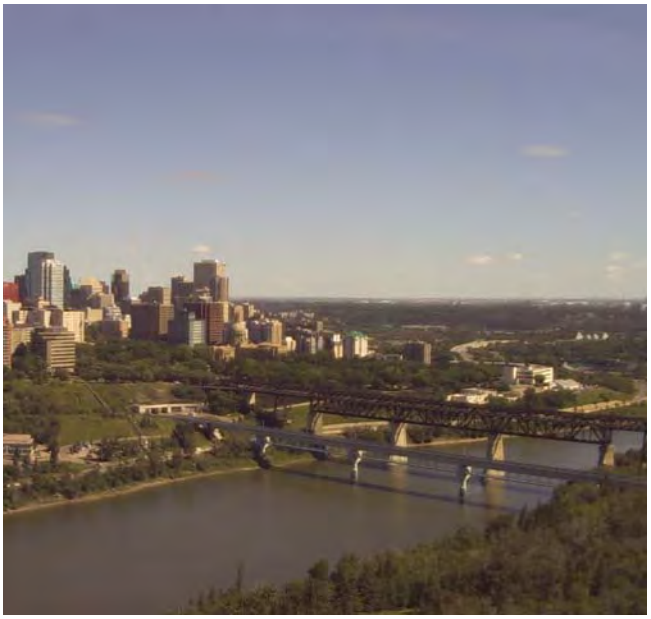
Connections

The CC5MPXCBL1 cable connects the camera to the power supply and is required to use the camera. This cable is also used to attach the camera to a datalogger COM port, MD485, or PC. Connection to the PC allows the camera to be configured via our Device Configuration utility (the DB9M-TERM interface that is shipped with the camera is also required).

An Ethernet cable is also required. Typically the CC5MPXCBL2 RJ45 Environmental Cable is used. The 13658 Ethernet cable can be used instead of the CC5MPXCBL2 for indoor connections or for temporary outdoor connections while the weather is good.

The connectors have metal caps that are chained to the camera.

The Ethernet cable connects the camera to a network router, cellular modem, or laptop. This connection allows access to a web interface used for camera configuration, targeting, and focusing. System status, date, time, and other information are also displayed on the web interface.



Above is a photograph taken by the CC5MPX camera. Campbell Scientific Canada installed the camera high above Edmonton's spectacular river valley on the University of Alberta's H.M. Tory Building. The camera records visual weather conditions every 15 minutes and transfers the image via FTP to a local server.

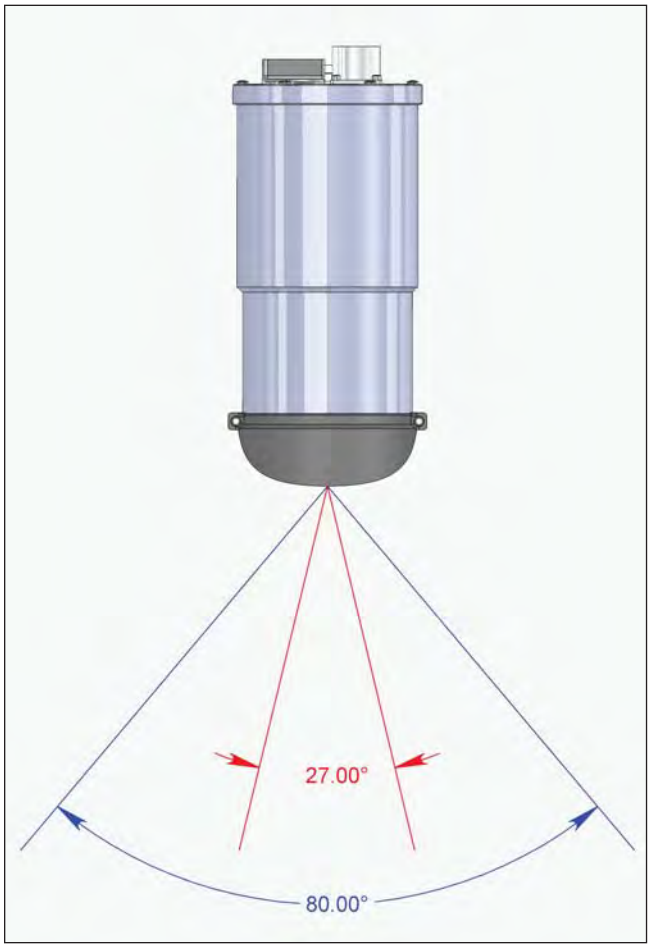
**With extreme icing or riming conditions and low temperatures, the CC5MPXWD's window defroster may not be able to clear the window due to the power constraints of the defroster.*

Ordering Information

Digital Cameras	
CC5MPX	CSC High Resolution Digital Network Camera (-40° to +60°C)
CC5MPXWD	CSC High Resolution Digital Network Camera with window defroster (-40° to +60°C)

Memory Option (choose one)	
-NC	No SD Memory Card
-4G	4 GB SD Memory Card
-8G	8 GB SD Memory Card

Accessories	
18549	CC5MPX Mounting Kit
CC5MPXCBL1-L	CC5MPX Power and I/O Cable. Enter cable length, in feet, after the -L. Maximum length is 100 ft.
CC5MPXCBL2-L	CC5MPX RJ45 Environmental Cable. Enter length, in feet, after the -L. Maximum length is 225 ft.
13658	10Base-T CAT5 Ethernet Cable with 7 ft length.



The CC5MPX has a 4 to 12 mm lens, which provides an approximate 27° horizontal field of view when fully zoomed in and an 80° horizontal field of view when fully zoomed out.

Specifications

Operating Power
- **CC5MPX:** 9 to 30 Vdc
- **CC5MPXWD:** 9 to 16 Vdc

Current Drain
- **Operating (camera only):** 250 mA (maximum at 12 Vdc)
- **Quiescent:** ≤1 mA (off power mode)
- **CC5MPXWD defroster on:** 1.2 A (maximum at 16 Vdc); 1 A (typical at 12 Vdc)

Operating Temperature: -40° to +60°C

CC5MPXWD Heating Element Resistance: 18 Ohm

Clock Accuracy: ±2 min./year (-40° to +60°C)

Lens
- **Size:** 4 to 12 mm
- **Mount:** C-type
- **IRIS:** DC compatible

Image or Video Capture Triggers: Two independent self timers; external trigger; motion detection; web page control

Programmable Still Image Resolutions (JPEG): 2592 x 1944; 1280 x 960; 1280 x 720; 640 x 480; 640 x 352; 320 x 240; 320 x 176

Video: Capable of up to 720P for 1280 x 720 (MPEG4) 640 x 480 (MJPEG), 320 x 240 (MPEG4)

External Input Signal
- **Logic Low Level:** 0.65 Vdc (-20 Vdc absolute min.)
- **Logic High Level:** >2.0 Vdc (+20 Vdc absolute max.)
- **Minimum Pulse Width:** 10 ms

Communication Interfaces: RS-232 port; RS-485 port; Ethernet 10/100

Communications Protocols: PakBus; FTP; email; Web page interface via web browser

Communication Switched Power Output
- **Maximum Output Current:** 750 mA

Maximum Baud Rate: 115.2 kbps (RS-232, RS-485 only)

Memory Card Interface
- **Type:** Secure Digital (SD)
- **File System:** FAT32
- **File Type:** JPEG (image), AVI (video)
- **Size:** Verified up to 16 GB

Image Capture Time (from wakeup to start of capture)
- **Fully On:** <1 s (5 MP images take longer)
- **Partially On:** 10 s
- **Deep Sleep:** 15 s
- **Off State:** 90 s

Dimensions
- **Diameter:** 3.7 in. (9.3 cm)
- **Length:** 8.7 in. (22 cm)

Weight: 2.34 lb (1.06 kg)

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CAMPBELL SCIENTIFIC®

WHEN MEASUREMENTS MATTER

CR1000

measurement & control datalogger

A rugged instrument with research-grade performance.

CR1000 Measurement and Control System

The CR1000 provides precision measurement capabilities in a rugged, battery-operated package. It consists of a measurement and control module and a wiring panel. Standard operating range is -25° to +50°C; an optional extended range of -55° to +85°C is available.

Input/Output Terminals—Individually configured for ratiometric resistive bridge, thermocouple, switch closure, high frequency pulse, low-level ac, serial sensors, and more.

Removable Power Terminal—simplifies connection to external power supply.

RS-232—provides a 9-pin DCE port for connecting a battery-powered laptop, serial sensors or RS-232 modems.

CS I/O Port—connects with AC-powered PCs and communication peripherals such as phone, RF, short-haul, and multidrop modems.

Peripheral Port—allows data to be stored on a CompactFlash card and/or supports Ethernet communications.

Features

- 4 Mbyte memory*
- Program execution rate of up to 100 Hz
- CS I/O and RS-232 serial ports
- 13-bit analog to digital conversions
- 16-bit H8S Renesas Microcontroller with 32-bit internal CPU architecture
- Temperature compensated real-time clock
- Background system calibration for accurate measurements over time and temperature changes
- Single DAC used for excitation and measurements to give ratio metric measurements
- Gas Discharge Tube (GDT) protected inputs
- Data values stored in tables with a time stamp and record number
- Battery-backed SRAM memory and clock ensuring data, programs, and accurate time are maintained while the CR1000 is disconnected from its main power source
- Serial communications with serial sensors and devices supported via I/O port pairs
- PakBus®, Modbus, DNP3, TCP/IP, FTP, and SMTP protocols supported

Measurement and Control Module

The module measures sensors, drives direct communications and telecommunications, reduces data, controls external devices, and stores data and programs in on-board, non-volatile storage. The electronics are RF shielded and glitch protected by the sealed, stainless steel canister. A battery-backed clock assures accurate timekeeping. The module can simultaneously provide measurement and communication functions. The on-board, BASIC-like programming language supports data processing and analysis routines.

Wiring Panel

The CR1000WP is a black, anodized aluminum wiring panel that is compatible with all CR1000 modules. The wiring panel includes switchable 12 V, redistributed analog grounds (dispersed among analog channels rather than grouped), unpluggable terminal block for 12 V connections, gas-tube spark gaps, and 12 V supply on pin 8 to power our COM-series phone modems and other peripherals. The control module easily disconnects from the wiring panel allowing field replacement without rewiring the sensors. A description of the wiring panel's input/output channels follows.

**Originally, the standard CR1000 had 2 MB of data/program storage, and an optional version, the CR1000-4M, had 4 MB of memory. In September 2007, the standard CR1000 started having 4 MB of memory, making the CR1000-4M obsolete. Dataloggers that have a module with a serial number greater than or equal to 11832 will have a 4 MB memory. The 4 MB dataloggers will also have a sticker on the canister stating "4M Memory".*

Analog Inputs
Eight differential (16 single-ended) channels measure voltage levels. Resolution on the most sensitive range is 0.67 µV.

Pulse Counters
Two pulse channels can count pulses from high level (5 V square wave), switch closure, or low level AC signals.

Switched Voltage Excitations
Three outputs provide precision excitation voltages for resistive bridge measurements.

Digital I/O Ports
Eight ports are provided for frequency measurements, digital control, and triggering. Three of these ports can also be used to measure SDM devices. The I/O ports can be paired as transmit and receive. Each pair has 0 to 5 V UART hardware that allows serial communications with serial sensors and devices. An RS232-to-logic level converter may be required in some cases.

CS I/O Port
AC-powered PCs and many communication peripherals connect with the CR1000 via this port. Connection to an AC-powered PC requires either an SC32B or SC-USB interface. These interfaces isolate the PC's electrical system from the datalogger, thereby protecting against ground loops, normal static discharge, and noise.

RS-232 Port
This non-isolated port is for connecting a battery-powered laptop, serial sensor, or RS-232 modem. Because of ground loop potential on some measurements (e.g., low level single-ended measurements), AC-powered PCs should use the CS I/O port instead of the RS-232 port (see above).

Peripheral Port
One 40-pin port interfaces with the NL115 Ethernet Interface & CompactFlash Module, the NL120 Ethernet Interface, or the CFM100 CompactFlash® Module.

Switched 12 Volt
This terminal provides unregulated 12 V that can be switched on and off under program control.

Storage Capacity
The CR1000 has 2 MB of flash memory for the Operating System, and 4 MB of battery-backed SRAM for CPU usage, program storage, and data storage. Data is stored in a table format. The storage capacity of the CR1000 can be increased by using a CompactFlash card.

Communication Protocols
The CR1000 supports the PakBus, Modbus, DNP3, TCP/IP, FTP, and SMTP communication protocols. With the PakBus protocol, networks have the distributed routing intelligence to continually evaluate links. Continually evaluating links optimizes delivery times and, in the case of delivery failure, allows automatic switch over to a configured backup route.

The Modbus RTU protocol supports both floating point and long formats. The datalogger can act as a slave and/or master.

The DNP3 protocol supports only long data formats. The dataloggers are level 2 slave compliant, with some of the operations found in a level 3 implementation.

The TCP/IP, FTP, and SMTP protocols provide TCP/IP functionality when the CR1000 is used in conjunction with an NL115, NL120, or third party serial IP device. Refer to the CR1000 manual for more information.

Power Supplies
Any 12 Vdc source can power the CR1000; a PS100 or BPALK is typically used. The PS100 provides a 7-Ahr sealed rechargeable battery that should be connected to a charging source (either a wall charger or solar panel). The BPALK consists of eight non-rechargeable D-cell alkaline batteries with a 7.5-Ahr rating at 20°C.

Also available are the BP12 and BP24 battery packs, which provide nominal ratings of 12 and 24 Ahrs, respectively. These batteries should be connected to a regulated charging source (e.g., a CH100 connected to a unregulated solar panel or wall charger).

Enclosure/Stack Bracket
A CR1000 housed in a weather-resistant enclosure can collect data under extremely harsh conditions. The 17565 Stack Bracket allows a small peripheral to be placed under the mounting bracket, thus conserving space. With the bracket, the CR1000 can be attached in a "horizontal" orientation in an ENC10/12 enclosure (i.e., the long axis of the CR1000 spanning the short axis of the enclosure).

Above is a CR1000 mounted to the stack bracket. The Velcro strap is for fastening a peripheral to the base of the bracket.

Data Storage and Retrieval Options

To determine the best option for an application, consider the accessibility of the site, availability of services (e.g., cellular phone or satellite coverage), quantity of data to collect, and desired time between data-collection sessions. Some communication options can be combined—increasing the flexibility, convenience, and reliability of the communications.

Keyboard Display

The CR1000KD can be used to program the CR1000, manually initiate data transfer, and display data. The CR1000KD displays 8 lines x 21 characters (64 x 128 pixels) and has a 16-character keyboard. Custom menus are supported allowing customers to set up choices within the datalogger program that can be initiated by a simple "toggle" or "pick list".

One CR1000KD can be carried from station to station in a CR1000 network.

Portable Handheld Devices

An Archer-PCon or user-supplied PDA can be used to collect and display the CR1000's data, transfer datalogger programs, graph data for up to two elements, and transfer the datalogger's data to a PC. User-supplied PDAs require either PConnect or PConnectCE software.

Direct Links

AC-powered PCs connect with the datalogger's CS I/O port via an SC32B or SC-USB interface. These interfaces provide optical isolation. A battery-powered laptop can be attached to the CR1000's RS-232 port via an RS-232 cable—no interface required.

External Data Storage Devices

A CFM100 or NL115 module can store the CR1000's data on an industrial-grade CompactFlash (CF) card (2 GB or less). The PC reads the CF card using either the CF1 CompactFlash Adapter or a 17752 USB Reader/Writer.

The CR1000 can also store data on an SC115 2-GB Flash Memory Drive. This light-weight device can easily be carried to the PC for data download.

CD295 DataView II Display

This two-line, 32-character LCD displays one real-time value, a description, and units. It is typically mounted in an enclosure lid, which allows customers to view the CR1000's data on-site without opening the enclosure.

Short Haul Modems

The SRM-5A RAD Short Haul Modem supports communications between the CR1000 and a PC via a four-wire unconditioned line (two twisted pairs).

Multidrop Interface

The MD485 intelligent RS-485 interface permits a PC to address and communicate with one or more dataloggers over the CABLE2TP two-twisted pair cable. Distances up to 4000 feet are supported.

Ethernet

Use of an NL120, NL115, or NL100 interface enables the CR1000 to communicate over a local network or a dedicated Internet connection via TCP/IP. The NL115 can also store data on a CompactFlash card.

Radios

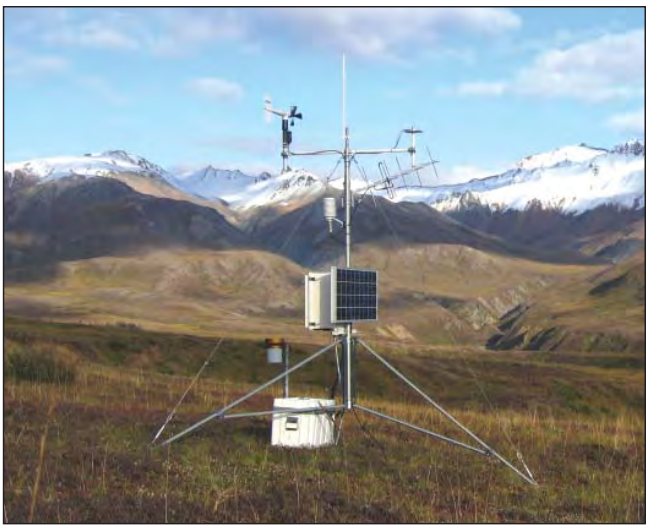
Radio frequency (RF) communications are supported via narrow-band UHF, narrow-band VHF, spread spectrum, or meteor burst radios. Line-of-sight is required for all of our RF options.

Telephone Networks

The CR1000 can communicate with a PC using landlines, cellular CDMA, or cellular GPRS transceivers. A voice synthesized modem enables anyone to call the CR1000 via phone and receive a verbal report of real-time site conditions.

Satellite Transmitters

Our NESDIS-certified GOES satellite transmitter provides one-way communications from a Data Collection Platform (DCP) to a receiving station. We also offer an Argos transmitter that is ideal for high-altitude and polar applications.



This weather station at Denali National Park, Alaska, transmits data via a GOES satellite transmitter.

Channel Expansion

4-Channel Low Level AC Module

The LLAC4 is a small peripheral device that allows customers to increase the number of available low-level ac inputs by using control ports. This module is often used to measure up to four anemometers, and is especially useful for wind profiling applications.

Synchronous Devices for Measurement (SDMs)

SDMs are addressable peripherals that expand the datalogger's measurement and control capabilities. For example, SDMs are available to add control ports, analog outputs, pulse count channels, interval timers, or even a CANbus interface to the system. Multiple SDMs, in any combination, can be connected to one datalogger.

Multiplexers

Multiplexers increase the number of sensors that can be measured by a CR1000 by sequentially connecting each sensor to the datalogger. Several multiplexers can be controlled by a single CR1000.

The CR1000 is compatible with the AM16/32B (shown above) and AM25T multiplexers.

Software

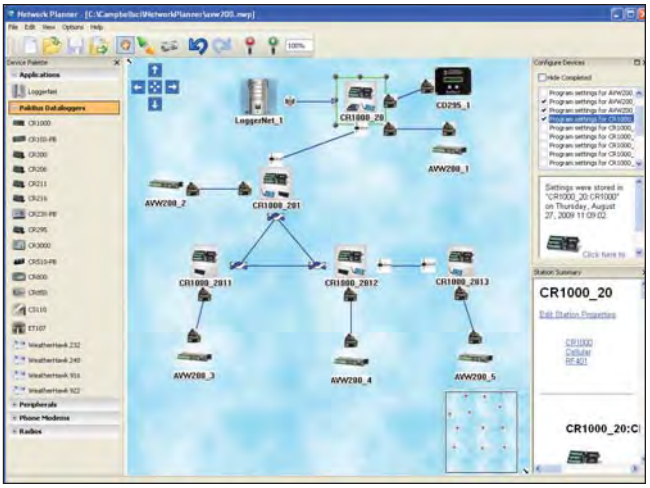
Starter Software

Our easy-to-use starter software is intended for first time users or applications that don't require sophisticated communications or datalogger program editing. SCWin Short Cut generates straight-forward CR1000 programs in four easy steps. PC200W allows customers to transfer a program to, or retrieve data from a CR1000 via a direct communications link.

At www.campbellsci.com/downloads you can download starter software at no charge. Our Resource CD also provides this software as well as PDF versions of our brochures and manuals.

Datalogger Support Software

Our datalogger support software packages provide more capabilities than our starter software. These software packages contains program editing, communications, and display tools that can support an entire datalogger network.

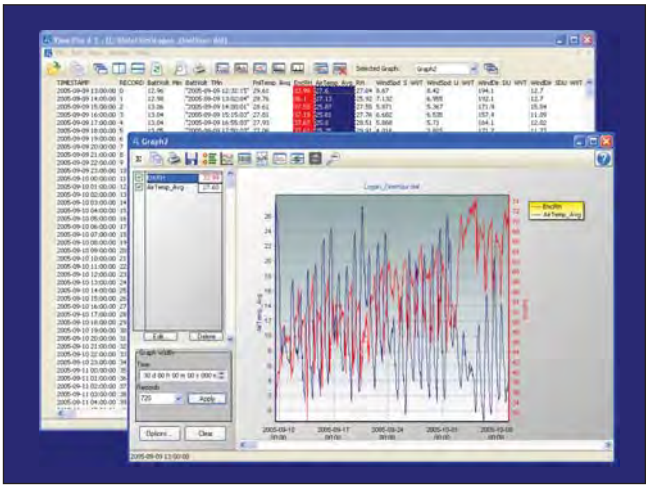


The Network Planner, included in LoggerNet 4 or higher, generates device settings and configures the LoggerNet network map for PakBus networks.

PC400, our mid-level software, supports a variety of telemetry options, manual data collection, and data display. For programming, it includes both Short Cut and the CRBasic program editor. PC400 does not support combined communication options (e.g., phone-to-RF), PakBus® routing, or scheduled data collection.

RTDAQ is an ideal solution for industrial and real-time users desiring to use reliable data collection software over a single telecommunications medium, and who do not rely on scheduled data collection. RTDAQ's strength lies in its ability to handle the display of high speed data.

LoggerNet is Campbell Scientific's full-featured datalogger support software. It is referred to as "full-featured" because it provides a way to accomplish almost all the tasks you'll need to complete when using a datalogger. LoggerNet supports combined communication options (e.g., phone-to-RF) and scheduled data collection.



Both LoggerNet and RTDAQ use View Pro to display historical data in a tabular or graphical format.

Applications

The measurement precision, flexibility, long-term reliability, and economical price of the CR1000 make it ideal for scientific, commercial, and industrial applications.

Meteorology

The CR1000 is used in long-term climatological monitoring, meteorological research, and routine weather measurement applications.

Our rugged, reliable weather station measures meteorological conditions at St. Mary's Lake, Glacier National Park, MT.

Sensors the CR1000 can measure include:

- cup, propeller, and sonic anemometers
- tipping bucket rain gages
- wind vanes
- pyranometers
- ultrasonic ranging sensor
- thermistors, RTDs, and thermocouples
- barometric pressure sensors
- RH sensors
- cooled mirror hygrometers

Agriculture and Agricultural Research

The versatility of the CR1000 allows measurement of agricultural processes and equipment in applications such as:

- plant water research
- canopy energy balance
- machinery performance
- plant pathology
- crop management decisions
- food processing/storage
- frost prediction
- irrigation scheduling
- integrated pest management

This vitaculture site in Australia integrates meteorological, soil, and crop measurements.

Wind Profiling

Our data acquisition systems can monitor conditions at wind assessment sites, at producing wind farms, and along transmission lines. The CR1000 makes and records measurements, controls electrical devices, and can function as PLCs or RTUs. Because the datalogger has its own power supply (batteries, solar panels), it can continue to measure and store data and perform control during power outages.

Typical sensors for wind assessment applications include, but are not limited to:

- sonic anemometers
- three-cup and propeller anemometers (up to 10 anemometers can be measured by using two LLAC4 peripherals)
- wind vanes
- temperature sensors
- barometric pressure
- wetness
- solar radiation

Photo courtesy npower renewables

A Campbell Scientific system monitors an offshore wind farm in North Wales.

For turbine performance applications, the CR1000 monitors electrical current, voltage, wattage, stress, and torque.

Soil Moisture

The CR1000 is compatible with the following soil moisture measurement technologies:

- Soil moisture blocks are inexpensive sensors that estimate soil water potential.
- Matric water potential sensors also estimate soil water potential but are more durable than soil moisture blocks.
- Time-Domain Reflectometry Systems (TDR) use a reflectometer controlled by a CR1000 to accurately measure soil water content. Multiplexers allow sequential measurement of a large number of probes by one reflectometer, reducing cost per measurement.
- Self-contained water content reflectometers are sensors that emit and measure a TDR pulse.
- Tensiometers measure the soil pore pressure of irrigated soils and calculate soil moisture.

Air Quality

The CR1000 can monitor and control gas analyzers, particle samplers, and visibility sensors. It can also automatically control calibration sequences and compute conditional averages that exclude invalid data (e.g., data recorded during power failures or calibration intervals).

Road Weather/RWIS

Our fully NTCIP-compliant Environmental Sensor Stations (ESS) are robust, reliable weather stations used for road weather/RWIS applications. A typical ESS includes a tower, CR1000, two road sensors, remote communication hardware, and sensors that measure wind speed and direction, air temperature, humidity, barometric pressure, solar radiation, and precipitation.

Water Resources/Aquaculture

Our CR1000 is well-suited to remote, unattended monitoring of hydrologic conditions. Most hydrologic sensors, including SDI-12 probes, interface directly to the CR1000. Typical hydrologic measurements:

- **Water level** is monitored with incremental shaft encoders, double bubblers, ultrasonic ranging sensors, resistance tapes, strain gage pressure transducers, or vibrating wire pressure transducers. Vibrating wire transducers require an AVW200-series or another vibrating wire interface.
- **Ionic conductivity** measurements use one of the switched excitation ports from the CR1000.
- **Samplers** are controlled by the CR1000 as a function of time, water quality, or water level.
- **Alarm and pump actuation** are controlled through digital I/O ports that operate external relay drivers.

A turbidity sensor was installed in a tributary of the Cedar River watershed to monitor water quality conditions for the city of Seattle, Washington.

Vehicle Testing

This versatile, rugged datalogger is ideally suited for testing cold and hot temperature, high altitude, off-highway, and cross-country performance. The CR1000 is compatible with our SDM-CAN interface and GPS16X-HVS receiver.

Vehicle monitoring includes not only passenger cars, but airplanes, locomotives, helicopters, tractors, buses, heavy trucks, drilling rigs, race cars, and motorcycles.

The CR1000 can measure:

- **Suspension**—strut pressure, spring force, travel, mounting point stress, deflection, ride
- **Fuel system**—line and tank pressure, flow, temperature, injection timing
- **Comfort control**— fan speed, ambient and supply air temperature, refrigerant pressures, solar radiation, ac on and off, time-to-comfort, blower current
- **Brakes**—line pressure, pedal pressure and travel, ABS, line and pad temperature
- **Engine**—pressure, temperature, crank position, RPM, time-to-start, oil pump cavitation
- **General vehicle**—chassis monitoring, road noise, vehicle position and speed, steering, air bag, hot/cold soaks, wind tunnels, traction, CANbus, wiper speed and current, vehicle electrical loads

Other Applications

- Eddy covariance systems
- Wireless sensor/datalogger networks
- Mesonet systems
- Avalanche forecasting, snow science, polar, high altitude
- Fire weather
- Geotechnical
- Historic preservation

CR1000 Specifications

Electrical specifications are valid over a -25° to +50°C range unless otherwise specified; non-condensing environment required. To maintain electrical specifications, Campbell Scientific recommends recalibrating dataloggers every two years. We recommend that the system configuration and critical specifications are confirmed with Campbell Scientific before purchase.

PROGRAM EXECUTION RATE

10 ms to one day @ 10 ms increments

ANALOG INPUTS (SE1-SE16 or DIFF1-DIFF8)

8 differential (DF) or 16 single-ended (SE) individually configured. Channel expansion provided by AM16/32B and AM25T multiplexers.

RANGES and RESOLUTION: Basic resolution (Basic Res) is the A/D resolution of a single conversion. Resolution of DF measurements with input reversal is half the Basic Res.

Range (mV)[1]	*DF Res (µV)* [2]	*Basic Res (µV)*
±5000	667	1333
±2500	333	667
±250	33.3	66.7
±25	3.33	6.7
±7.5	1.0	2.0
±2.5	0.33	0.67

[1]Range overhead of ~9% on all ranges guarantees that full-scale values will not cause over range.

[2]Resolution of DF measurements with input reversal.

ACCURACY[3]:
±(0.06% of reading + offset), 0° to 40°C
±(0.12% of reading + offset), -25° to 50°C
±(0.18% of reading + offset), -55° to 85°C (-XT only)

[3]Accuracy does not include the sensor and measurement noise. The offsets are defined as:
Offset for DF w/input reversal = 1.5·Basic Res + 1.0 µV
Offset for DF w/o input reversal = 3·Basic Res + 2.0 µV
Offset for SE = 3·Basic Res + 3.0 µV

INPUT NOISE VOLTAGE: For DF measurements with input reversal on ±2.5 mV input range; digital resolution dominates for higher ranges.

250 µs Integration: 0.34 µV RMS
50/60 Hz Integration: 0.19 µV RMS

ANALOG MEASUREMENT SPEED:

Integration Type/ Code	*Integration Time*	*Settling Time*	*Total Time*[5] *SE w/ No Rev*	*Total Time*[5] *DF w/ Input Rev*
250	250 µs	450 µs	~1 ms	~12 ms
60 Hz[4]	16.67 ms	3 ms	~20 ms	~40 ms
50 Hz[4]	20.00 ms	3 ms	~25 ms	~50 ms

[4]AC line noise filter.

[5]Includes 250 µs for conversion to engineering units.

INPUT LIMITS: ±5 V

DC COMMON MODE REJECTION: >100 dB

NORMAL MODE REJECTION: 70 dB @ 60 Hz when using 60 Hz rejection

SUSTAINED INPUT VOLTAGE W/O DAMAGE: ±16 Vdc max.

INPUT CURRENT: ±1 nA typical, ±6 nA max. @ 50°C; ±90 nA @ 85°C

INPUT RESISTANCE: 20 Gohms typical

ACCURACY OF BUILT-IN REFERENCE JUNCTION THERMISTOR (for thermocouple measurements):
±0.3°C, -25° to 50°C
±0.8°C, -55° to 85°C (-XT only)

ANALOG OUTPUTS (Vx1-Vx3)

3 switched voltage, active only during measurement, one at a time.

RANGE AND RESOLUTION: Voltage outputs programmable between ±2.5 V with 0.67 mV resolution.

V_x ACCURACY: ±(0.06% of setting + 0.8 mV), 0° to 40°C
±(0.12% of setting + 0.8 mV), -25° to 50°C
±(0.18% of setting + 0.8 mV), -55° to 85°C (-XT only)

V_x FREQUENCY SWEEP FUNCTION: Switched outputs provide a programmable swept frequency, 0 to 2500 mv square waves for exciting vibrating wire transducers.

CURRENT SOURCING/SINKING: ±25 mA

RESISTANCE MEASUREMENTS

MEASUREMENT TYPES: The CR1000 provides ratiometric measurements of 4- and 6-wire full bridges, and 2-, 3-, and 4-wire half bridges. Precise, dual polarity excitation using any of the 3 switched voltage excitations eliminates dc errors.

VOLTAGE RATIO ACCURACY[6]: Assuming excitation voltage of at least 1000 mV, not including bridge resistor error.

±(0.04% of voltage reading + offset)/V_x

[6]Accuracy does not include the sensor and measurement noise. The offsets are defined as:
Offset for DF w/input reversal = 1.5·Basic Res + 1.0 µV
Offset for DF w/o input reversal = 3·Basic Res + 2.0 µV
Offset for SE = 3·Basic Res + 3.0 µV

Offset values are reduced by a factor of 2 when excitation reversal is used.

PERIOD AVERAGE

Any of the16 SE analog inputs can be used for period averaging. Accuracy is ±(0.01% of reading + resolution), where resolution is 136 ns divided by the specified number of cycles to be measured.

INPUT AMPLITUDE AND FREQUENCY:

Voltage Gain	*Input Range (±mV)*	*Signal (peak to peak)*[7] *Min. (mV)*	*Signal (peak to peak)*[7] *Max (V)*	*Min Pulse Width (µV)*	*Max*[8] *Freq (kHz)*
1	2500	500	10	2.5	200
10	250	10	2	10	50
33	25	5	2	62	8
100	2.5	2	2	100	5

[7]With signal centered at the datalogger ground.

[8]The maximum frequency = 1/(Twice Minimum Pulse Width) for 50% of duty cycle signals.

PULSE COUNTERS (P1-P2)

(2) inputs individually selectable for switch closure, high frequency pulse, or low-level ac. Independent 24-bit counters for each input.

MAXIMUM COUNTS PER SCAN: 16.7×10^6

SWITCH CLOSURE MODE:
Minimum Switch Closed Time: 5 ms
Minimum Switch Open Time: 6 ms
Max. Bounce Time: 1 ms open w/o being counted

HIGH-FREQUENCY PULSE MODE:
Maximum Input Frequency: 250 kHz
Maximum Input Voltage: ±20 V
Voltage Thresholds: Count upon transition from below 0.9 V to above 2.2 V after input filter with 1.2 µs time constant.

LOW-LEVEL AC MODE: Internal AC coupling removes AC offsets up to ±0.5 V.
Input Hysteresis: 12 mV @ 1 Hz
Maximum ac Input Voltage: ±20 V
Minimum ac Input Voltage:

Sine Wave (mV RMS)	*Range(Hz)*
20	1.0 to 20
200	0.5 to 200
2000	0.3 to 10,000
5000	0.3 to 20,000

DIGITAL I/O PORTS (C1-C8)

8 ports software selectable, as binary inputs or control outputs. Also provide edge timing, subroutine interrupts/wake up, switch closure pulse counting, high frequency pulse counting, asynchronous communications (UART), SDI-12 communications, and SDM communications.

HIGH-FREQUENCY MAX: 400 kHz

SWITCH CLOSURE FREQUENCY MAX: 150 Hz

EDGE TIMING RESOLUTION: 540 ns

OUTPUT VOLTAGES (no load): high 5.0 V ±0.1 V; low <0.1

OUTPUT RESISTANCE: 330 ohms

INPUT STATE: high 3.8 to 16 V; low -8.0 to 1.2 V

INPUT HYSTERESIS: 1.4 V

INPUT RESISTANCE: 100 kohms

SWITCHED 12 V (SW-12)

One independent 12 V unregulated sources switched on and off under program control. Thermal fuse hold current = 900 mA @ 20°C, 650 mA @ 50°C, 360 mA @ 85°C.

CE COMPLIANCE

STANDARD(S) TO WHICH CONFORMITY IS DECLARED: IEC61326:2002

COMMUNICATIONS

RS-232 PORTS:
9-pin: DCE port for battery-powered computer or non-CSI modem connection.
COM1 to COM4: Four independent Tx/Rx pairs on control ports (non-isolated); 0 to 5 VUART
Baud Rates: selectable from 300 bps to 115.2 kbps.
Default Format: 8 data bits; 1 stop bits; no parity
Optional Formats: 7 data bits; 2 stop bits; odd, even parity

CS I/O PORT: Interface with CSI peripherals

SDI-12: Digital control ports 1, 3, 5, and 7 are individually configured and meet SDI-12 Standard version 1.3 for datalogger mode. Up to ten SDI-12 sensors are supported per port.

PERIPHERAL PORT: 40-pin interface for attaching CompactFlash or Ethernet peripherals

PROTOCOLS SUPPORTED: PakBus, Modbus, DNP3, FTP, HTTP, XML, POP3, SMTP, Telnet, NTCIP, NTP, SDI-12, SDM

CPU AND INTERFACE

PROCESSOR: Renesas H8S 2322 (16-bit CPU with 32-bit internal core)

MEMORY: 2 MB of Flash for operating system; 4 MB of battery-backed SRAM for CPU usage, program storage and data storage.

CLOCK ACCURACY: ±3 min. per year. Correction via GPS optional.

SYSTEM POWER REQUIREMENTS

VOLTAGE: 9.6 to 16 Vdc (reverse polarity protected)

EXTERNAL BATTERIES: 12 Vdc nominal

TYPICAL CURRENT DRAIN:
Sleep Mode: ~0.6 mA
1 Hz Sample Rate (1 fast SE meas.): 1 mA
100 Hz Sample Rate (1 fast SE meas.): 16.2 mA
100 Hz Sample Rate (1 fast SE meas. w/RS-232 communication): 27.6 mA
Optional Keyboard Display On (no backlight): add 7 mA to current drain
Optional Keyboard Display On (backlight on): add 100 mA to current drain

PHYSICAL

DIMENSIONS: 9.4" x 4" x 2.4" (23.9 x 10.2 x 6.1 cm); additional clearance required for serial cable and sensor leads.

WEIGHT: 2.1 lbs (1 kg)

WARRANTY

3-years against defects in materials and workmanship.

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CS106

Barometric Pressure Sensor

CAMPBELL SCIENTIFIC®
WHEN MEASUREMENTS MATTER

The CS106 barometer uses Vaisala's BAROCAP silicon capacitive sensor to measure barometric pressure over a 500 to 1100 millibar range. The CS106 outputs a linear signal of 0 to 2.5 Vdc, allowing it to be directly connected to Campbell Scientific dataloggers. The CS106 is compatible with all of our contemporary dataloggers and many of our retired dataloggers (e.g., CR510, CR10(X), CR23X).

Construction and Mounting

The CS106 is encased in a plastic shell (ABS/PC blend) fitted with an intake valve for pressure equilibration. It includes a 2.5 ft cable and a terminal strip for datalogger power and signal connections. The CS106 is typically mounted next to the datalogger inside an ENC12/14 or larger enclosure. The ENC100 is available for housing the CS106 in its own enclosure.

Ordering Information

Barometric Pressure Sensor	
CS106	Vaisala PTB110 Barometer (500 to 1100 mb), with 30 in. cable.

Accessories	
The following accessories are used when the barometer will be housed in a different enclosure than the datalogger.	
ENC100	6.7 in. by 5.5 in enclosure for housing only the CS106.
CABLE5CBL-L	5-conductor, 24 AWG cable with drain wire and Santoprene jacket. Enter cable length, in feet, after the -L. Must choose a cable termination option (see below).

Cable Termination Options (choose one)	
-PT	Cable terminates in pigtails for direct connection to datalogger's terminals.
-PW	Cable terminates in a connector for attachment to a prewired enclosure.

The ENC100 is a very small enclosure that can house one CS106. It includes a backplate, compression fitting, vent, and mounting bracket.

The CS106 includes a switching circuit that allows the datalogger to power the barometer only during measurement, which reduces power consumption. Sensor warm-up and measurement time is one second minimum.

Manufacturer's Specifications

Total Accuracy[1]:	±0.3 mb @ +20°C ±0.6 mb @ 0° to 40°C ±1.0 mb @ -20° to +45°C ±1.5 mb @ -40° to +60°C
Linearity:	±0.25 mb
Hysteresis:	±0.03 mb
Repeatability:	±0.03 mb
Calibration Uncertainty:	±0.15 mb
Long-Term Stability:	±0.1 mb per year
Operating Temperature:	-40° to +60°C
Dimensions:	2.7" x 3.8" x 1.1" (6.8 cm x 9.7 cm x 2.8 cm)
Weight:	3.2 oz (90 g)
Supply Voltage:	10 to 30 Vdc
Current Consumption:	<4 mA (active), <1 µA (quiescent)
Settling Time:	1 second to reach full accuracy after power-up
Response Time:	500 ms to reach full accuracy after a pressure step

[1]*The root sum squared (RSS) of end point non-linearity, hysteresis, repeatability, and calibration uncertainty.*

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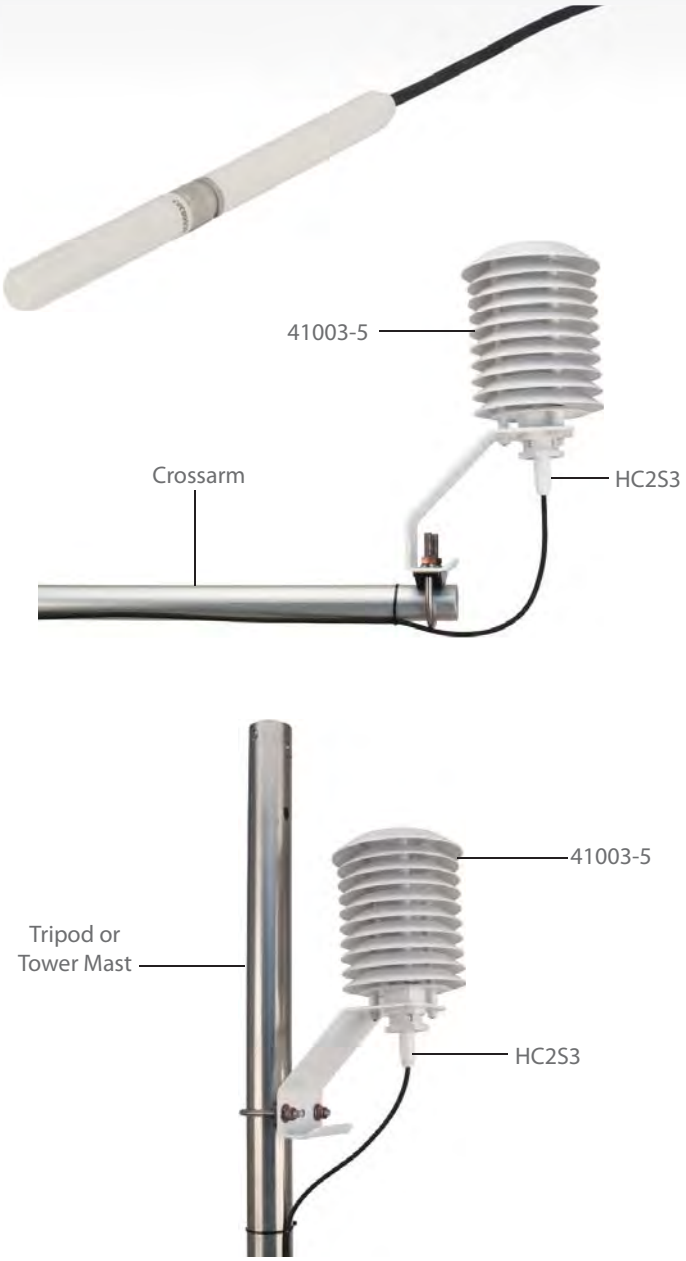
WHEN MEASUREMENTS MATTER

HC2S3

Temperature and RH Sensor

The HC2S3 is a rugged, accurate temperature/RH probe that is ideal for long-term, unattended applications. The probe uses a Rotronic's IN1 capacitive sensor to measure RH and a 100 ohm PRT to measure temperature. For optimum results, the HC2S3 should be recalibrated annually.

The HC2S3 comes with a polyethylene filter that protects its sensor from fine dust and particles and minimizes water absorption and retention. Alternatively, a teflon filter is available for marine environments. The response time is slower when using the teflon filter.



Sensor Mounts

The 41003-5 radiation shield should be used when the HC2S3 is exposed to sunlight. The 41003-5 can attach directly to a mast or tower leg or to a CM202, CM204, or CM206 crossarm.

Ordering Information

Air Temperature and Relative Humidity Probe

HC2S3-L Rotronics Temperature/RH Probe with user-specified cable length. Enter cable length, in feet, after the -L. The maximum cable length is 1000 ft. Must choose a cable termination option (see below).

Cable Termination Options (choose one)

-PT Cable terminates in stripped and tinned leads for direct connection to a datalogger's terminals.

-PW Cable terminates in connector for attachment to a prewired enclosure.

-CWS Cable terminates in a connector for attachment to a CWS900-series interface. Connection to a CWS900-series interface allows this sensor to be used in a wireless sensor network.

Accessories

41003-5 10-Plate Gill Radiation Shield to house the HC2S3

27755 Teflon Filter for marine environments.

Recommended Cable Lengths

2-m Height		Atop a tripod or tower via a 2-ft crossarm such as the CM202								
Mast/Leg	**CM202**	**CM6**	**CM106**	**CM10**	**CM110**	**CM115**	**CM120**	**UT10**	**UT20**	**UT30**
9 ft	11 ft	11 ft	14 ft	14 ft	14 ft	19 ft	24 ft	14 ft	24 ft	37 ft

Note: *Add two feet to the cable length if mounting the enclosure to the leg base of a CM106, CM110, CM115, or CM120 tripod.*

Specifications

Electronics

Operating Limits:	-40° to +100°C
Storage Temperature:	-50° to +100°C
Dimensions	
Diameter:	15 mm (0.6 in.)
Length:	168 mm (6.6 in.)
Weight:	10 g (0.35 oz)
Filter:	Polyethylene or Teflon
Current Consumption:	<4.5 mA @ 3.3 Vdc <4.3 mA @ 5 Vdc <2.0 mA @ 12 Vdc
Supply Voltage:	5 to 24 Vdc
Maximum Startup Current:	<50 mA for 2 µs

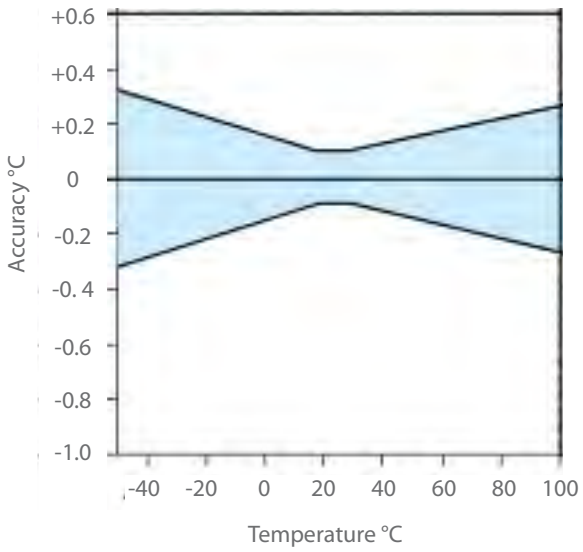
Air Temperature

Temperature Sensor:	PT100 RTD, IEC 751 1/3 Class B
Measurement Range:	-50° to +100°C (default to -40° to +60°C)
Output Signal Range:	0 to 1 V
Long Term Stability:	<0.1°C/year
Sensor Time Constant:	Typical 4 s, 63% step change (1 m/s air flow at sensor)
Temperature Accuracy:	see graph at top right

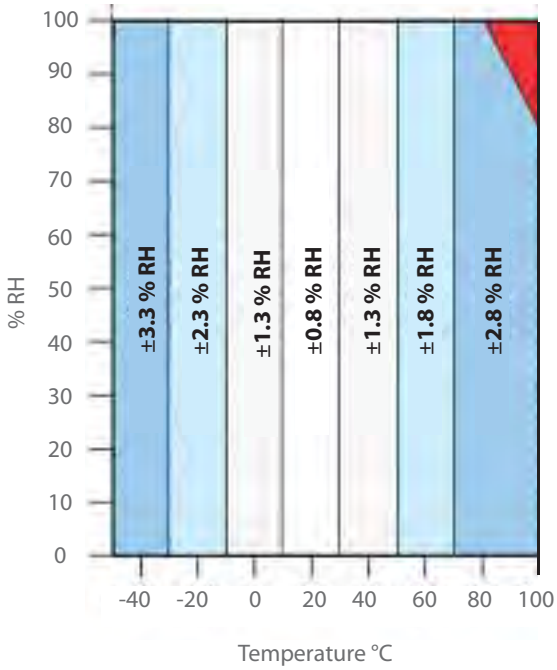
Relative Humidity (RH)

Sensor:	ROTRONIC Hygromer IN-1
Measurement Range:	0 to 100% RH, non-condensing
Output Signal Range:	0 to 1 Vdc
Accuracy at 23°C:	±0.8% RH with standard configuration settings
Long-Term Stability:	<1% RH per year
Response Time:	Typical 10 s, 63% of a 35% to 80% RH step change (1 m/s air flow at sensor)
RH Accuracy over Temperature:	see graph at bottom right

Temperature Accuracy Graph



RH Accuracy Graph



Note: *The black outer jacket of the cable is Santoprene® rubber. This compound was chosen for its resistance to temperature extremes, moisture, and UV degradation. However, this jacket will support combustion in air. It is rated as slow burning when tested according to U.L. 94 H.B. and will pass FMVSS302. Local fire codes may preclude its use inside buildings.*

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Instrumentation Mounts

Crossarms, Solar Radiation Mounts, Radiation Shields

CAMPBELL SCIENTIFIC®
WHEN MEASUREMENTS MATTER

Campbell Scientific offers a variety of instrument mounts to attach sensors and peripherals to our light-weight tripods (CM110, CM115, CM120), galvanized-steel tripods (CM6, CM10), and towers (UT10, UT20, UT30). This equipment includes crossarms, brackets, solar radiation sensor mounts, and radiation shields.

U-Bolts

U-bolts are often included with our mounts to attach them to a tripod or tower mast, tower leg, sensor mounting pipe, antenna, or user-supplied pole. The u-bolts support the following outer diameters (OD):

U-bolt Description	Nominal Pipe Size	Outer Diameter (OD) Range
1.5 in.	0.75 to 1 in.	1.0 to 1.5 in. (2.54 to 3.81 cm)
2 in.	1 to 1.5 in.	1.3 to 2.1 in. (3.3 to 5.33 cm)
2 in. with plastic v-block	0.75 to 1.5 in.	1.0 to 2.1 in. (2.54 to 5.33 cm)

Crossarms and Crossarm Bracket

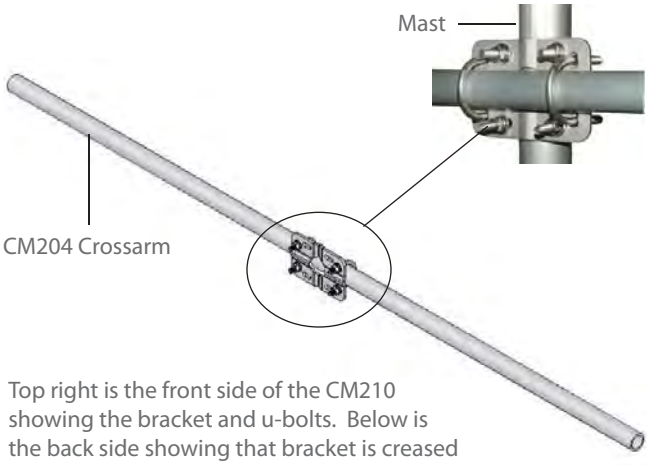
CM200-Series Crossarms

The CM202, CM204, and CM206 crossarms place sensors a few feet away from the midline of the tripod or tower, thereby reducing the effects of the tripod or tower on the sensor's measurement. These crossarms consist of a 1-in. IPS anodized aluminum pipe and a CM210 bracket that attaches to the tripod or tower. Sensors are mounted to the end of the crossarm using an appropriate mount such as a CM220 Right Angle Mounting Bracket. A u-bolt mounting scheme allows customers to place the crossarm at the optimal measurement height for the sensor.

The CM202, CM204, and CM206 differ in their length and the number of sensors that can be attached to them; one sensor can be attached to the CM202 and up to two sensors can be attached to the CM204 and CM206.

SPECIFICATIONS			
	CM202	CM204	CM206
Length	2 ft (0.6 m)	4 ft (1.3 m)	6 ft (1.8 m)
OD	1.31 in. (3.33 cm)	1.31 in. (3.33 cm)	1.31 in. (3.33 cm)
Weight	2.3 lbs (1.04 kg)	3.65 lbs (1.66 kg)	5 lbs (2.27 kg)

A CM206 crossarm is mounted atop this UT30 30 ft tower. On each end of the crossarm, a CM220 bracket is used to attach a 27106T vertical anemometer. Two 43502 Aspirated Radiation Shields are also fastened to a leg of the tower.



Top right is the front side of the CM210 showing the bracket and u-bolts. Below is the back side showing that bracket is creased to allow pipes of varying diameters to seat snugly in it.

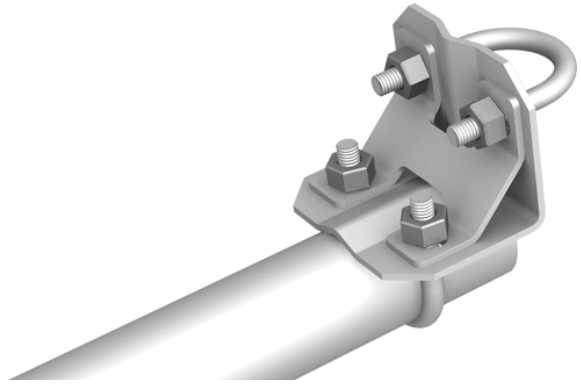
CM210 Crossarm Mounting Kit

The CM210 is included with our CM202, CM204, and CM206 crossarms but may also be ordered separately. When attaching a crossarm to a tower, purchasing a second CM210 may be desirable to secure the crossarm to two of the three tower legs. The CM210 is shipped with two 1.5-in. u-bolts and two 2-in. u-bolts allowing it to be attached to any of our tripods or towers.

SPECIFICATIONS	
Mounting Bracket Material	304 stainless steel bracket, with stainless-steel u-bolts and hardware
Weight	1.45 lbs (0.66 kg)
Dimensions	4 x 4.75 x 0.25 in. (10.2 x 12.07 x 0.64 cm)

General Mounts

Wind sets are attached to CM200-series crossarms either using a NU-RAIL fitting (shown above) or the CM220 mounting bracket (shown below).



A closeup of the CM220 Right Angle Mounting Bracket shows the construction and crossarm attachment.

NU-RAIL® Slip-On Crossover Fittings

NU-RAIL Slip On Offset Crossover Fittings are an option for connecting a sensor with a vertical pipe mount (e.g., most wind sensors) to a CM200-series crossarm. Campbell Scientific offers two sizes of NU-RAIL fittings. The 1049 NU-RAIL is used for sensors that have a 0.75-in. IPS mounting pipe, and the 17593 is used for sensors that have a 1-in. IPS mounting pipe (see below).

NU-RAIL/SENSOR COMPATIBILITY	
Sensors with 0.75-in. IPS Pipe	**Sensors with 1-in. IPS Pipe**
014A Anemometer, 03101 Anemometer, 27106T Vertical Anemometer	024A Wind Vane, 034B Wind Set, 03002 Wind Sentry Set, 05103 Wind Monitor, 05103-45 Alpine Wind Monitor, 05106 Wind Monitor Marine, 05305 Wind Monitor-AQ

CM220 Right Angle Mounting Bracket

The CM220 Right-Angle Mounting Bracket is another option for connecting a sensor with a vertical pipe mount to a CM200-series crossarm or a user-supplied pipe. It includes two 1.5-in. u-bolts.

CM216 Apex Sensor Mount

The CM216 provides a 0.75-in. or 1-in. IPS mounting pipe (1.05-in. or 1.32-in. OD) that extends above the mast. It allows a sensor with a 1.0-in. or 1.32-in. OD fitting (typically a wind sensor) to be attached to the top of a stainless-steel CM110, CM115, or CM120 tripod without a crossarm. Please note that a lightning rod cannot be used when this mount attaches a Wind Monitor or a 03002 Wind Sentry atop the tripod's mast. Therefore the CM216 is only recommended for mounting these sensors if the deployment is short term.

CM230 Adjustable Inclination Mount

The CM230 is primarily used with directional (Yagi) antennas, but can also be used with sensors that need to be pointed at a specific target (e.g., SI-111, SR50A). When using the CM230, fix the declination of the antenna or sensor by tightening a 2-in. u-bolt that mounts on the mast or user-supplied pipe. The inclination is then adjusted with a 1.5-in. u-bolt and nuts. The CM230 weighs 0.75 lbs (0.34 kg); dimensions are 3.0 x 3.75 x 3.5 in. (7.62 x 9.53 x 8.89 cm).

CM235 Magnetic Mounting Stand

The CM235 attaches a device with a magnetic base to a crossarm or mast via a 2-in. u-bolt with a plastic v-block. Devices that have a magnetic base include our GPS16X-HVS Geographic Position Receiver, GPS antennas, and some short-range omnidirectional antennas. The CM235 weighs 0.7 lbs (0.32 kg).

Solar Radiation Mounts

Leveling Bases

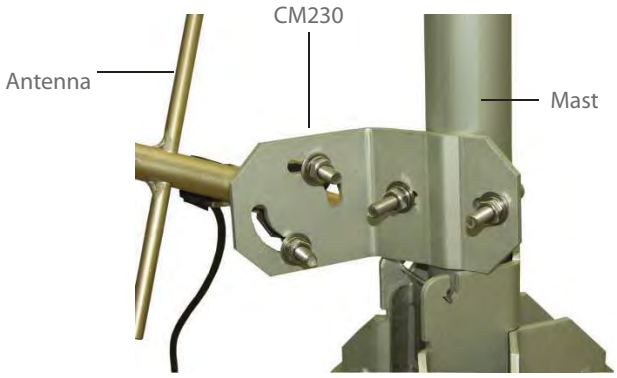
Campbell Scientific offers two leveling bases that support different sensors. The LI2003S leveling base supports the LI200X and LI190SB probes, and the 18356 supports the CS300 probe. Both leveling bases use a bubble level and three adjustable leveling screws to level the sensor. The CMP3 and LP02 pyranometers include their own bubble level and leveling screws allowing them to be attached directly to the CM225 Solar Sensor Mounting Stand (see below).

CM225 Solar Sensor Mounting Stand

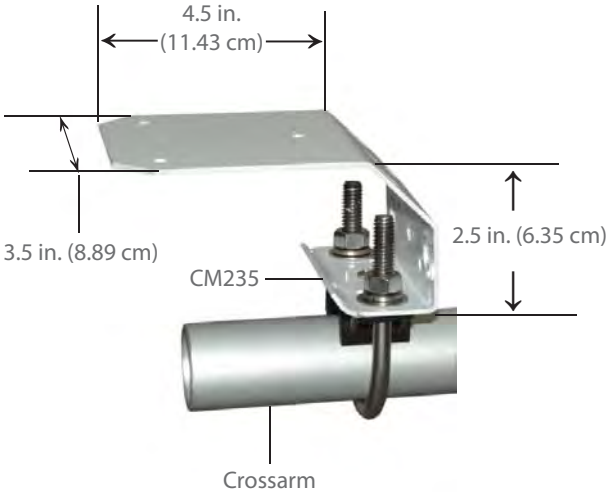
The CM225 mounting stand includes one 2-in. u-bolt with plastic v-block for attaching a solar radiation sensor to a crossarm or mast. Compatible sensors are the CS300, LI200X, LI190SB, CMP3, and LP02. The CMP3 and LP02 attach directly to the CM225. A leveling base (LI2003S or 18356) attaches the other sensors to the CM225 (see above). It weighs 0.75 lb. (0.34 kg); dimensions are 3.5 x 4.5 x 2.5 in. (8.9 x 11.3 x 6.4 cm).

26120 Net Radiation Sensor Mounting Kit

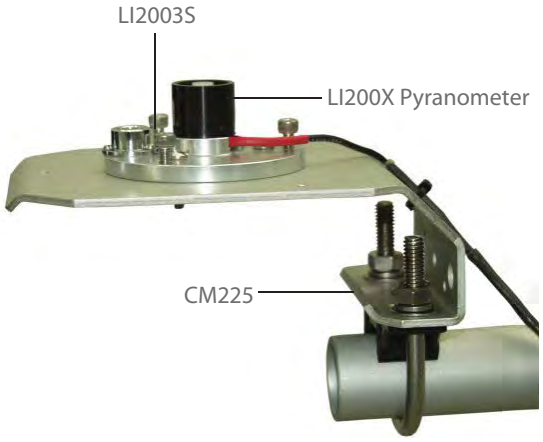
The 26120 Net Radiation Sensor Mounting Kit is used to attach a NR-LITE2, CNR4, or CNR2 sensor to a vertical pipe or to a CM200-series crossarm. It includes adjustment screws to level the radiation sensor. The sensor should be mounted at least 1.5 m above the ground to avoid shading effects and to promote spatial averaging. Campbell Scientific recommends mounting our net radiation sensors at least 25 ft away from other structures in the monitoring system.



A CM230 supporting a Yagi antenna is attached to a mast. Only the first cross-element of the Yagi antenna is shown.



The three holes on the top plate of the CM235 are for mounting the device's magnetic base.



The CM225's u-bolt is placed in the holes on the bottom of the bracket for attachment to a crossarm. An LI2003S and a LI200X reside on the CM225.

Radiation Shields for Temperature and Temperature/RH Probes

Naturally-Aspirated Radiation Shields

Campbell Scientific offers six-plate, 10-plate, and 14-plate naturally-aspirated radiation shields. The diameter of each plate is 4.7 in. (11.9 cm). Their louvered construction allows air to pass freely through the shield, thereby keeping the probe at or near ambient temperature. These radiation shields mount to a crossarm, mast, or tower leg via a 2-in. u-bolt with a plastic v-block.

The 41303-5A is our six-plate shield that weighs 0.9 lb (0.41 kg) and has a 4.5-in. (11.4 cm) height. It can house a 107, 108, 109, CS215, or HMP60 probe.

The 41003-5 is our 10-plate shield that weighs 1.3 lb (0.59 kg) and has an 8.0-in. (20.3 cm) height. It typically houses an HMP45C probe, but can also house a 107, 108, 109, HMP60, or 43347 probe; additional hardware is required (see table below).

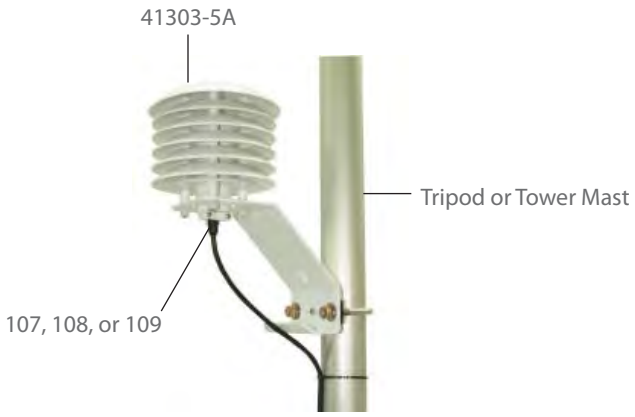
REQUIRED HARDWARE		
107, 108, 109	**HMP60**	**43347**
41322 Adapter Plate	41322 Adapter Plate (mount in lower part of shield) **--or--** 41381 Extension Tube, 6637 Split Nut Plug, #18278 Cable (mount in upper part of shield)	27251 Split Nut Plug

The 41005-5 is our 14-plate shield used to house and protect the HMP155A Temperature and RH Probe.

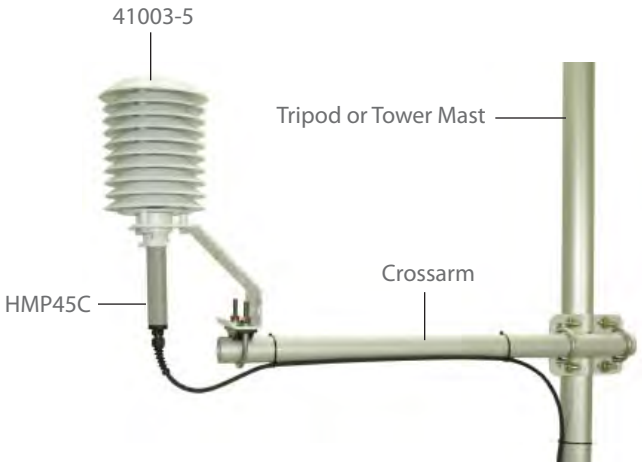
Fan-Aspirated Radiation Shield

R. M. Young's 43502 Aspirated Radiation Shield typically houses the 43347 R. M. Young RTD Temperature Probe (other temperature sensors may also fit inside this shield). The shield employs concentric downward facing intake tubes and a small canopy shade to isolate the temperature probe from direct and indirect radiation. A brushless 12 Vdc blower motor pulls ambient air into the shield and across the probe to reduce radiation errors. This allows temperature to be measured with an RMS error of less than ±0.2°C. The blower operates off a 115 Vac to 12 Vdc transformer that is included with the shield.

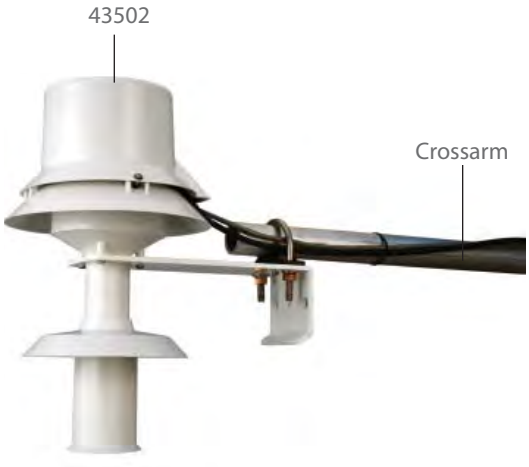
The 43502 shield attaches to a crossarm, mast, or tower leg via a 2-in. u-bolt with a plastic v-block. Another CM210 Crossarm Mounting Kit is often desirable to attach the crossarm to two tower legs—providing additional stability. The 43502 has a 13-in. (33 cm) length and an 8-in. (20 cm) diameter.



The u-bolt is placed in the holes on the side of the bracket to allow the 41303-5A to be attached to a mast or vertical pole.



The u-bolt is placed in the holes on the bottom of the bracket for attachment to a crossarm.



This 43502 is mounted to a crossarm. The UT30 tower on page one has two 43502 shields mounted to its leg.

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NL120

10baseT Ethernet Module

Campbell Scientific's NL120 allows a CR1000 or CR3000 datalogger to communicate over a local network or a dedicated Internet connection via TCP/IP. This 10baseT Ethernet module connects directly with the 40-pin peripheral port on a CR1000 or CR3000. It is the smallest Ethernet module available for those dataloggers.

A 10baseT Ethernet straight through cable is used when the cable is run from a hub to the NL120. A 10baseT Ethernet crossover cable is used if the cable is run directly from the computer to the NL120. For cable lengths longer than 9 feet, the 10baseT Ethernet cable must be shielded.

The NL120 is set up using the Device Configuration utility (DevConfig). DevConfig is bundled with our PC400, RTDAQ, and LoggerNet software and is available, at no charge, from: www.campbellsci.com/downloads

The NL120 is the smallest Ethernet Module available for our CR1000 and CR3000.

Ordering Information

Model	Description
NL120	Ethernet Interface
Ethernet Cables	
13658	10baseT Ethernet straight through cable (7 ft)
13659	10baseT Ethernet crossover cable (7 ft)

The NL120 fastens to the peripheral port on a CR1000 (shown above) or CR3000 datalogger.

Specifications

Power:
12 V supplied through the datalogger's peripheral port

Current Drain: 20 mA

EMI and ESD Protection:
Meets requirements for a class A device under European Standards
Application of Council Directive(s):
89/336/EEC as amended by 89/336/EEC and 93/68/EEC
Standards to which conformity is declared:
EN55022-1; 1995 and EN50082-1: 1992

Temperature Range:
-25° to +50°C standard; -40° to +85°C extended

Software Requirements:
- LoggerNet 3.2 or later
- PC400 1.3 or later
- DevConfig 1.5 or later

Cable Requirements:
Ethernet cable must be shielded if the length is greater than 9 ft.

Dimensions:
4.0" x 2.5" x 1.1" (10.2 x 6.4 x 2.8 cm)

Weight: 2.35 oz (66.62 g)

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BPALK and PS100

Power Supplies for CR800, CR850, and CR1000

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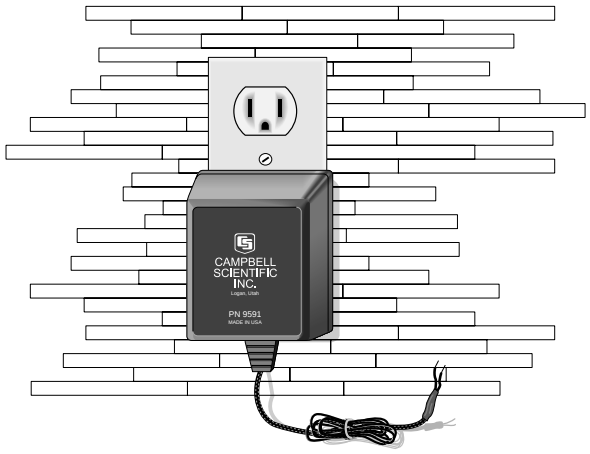
WHEN MEASUREMENTS MATTER

The BPALK Alkaline Battery Pack includes eight "D" cell batteries for powering a CR800, CR850, or CR1000 datalogger.

The PS100 is used with our CR800, CR850, or CR1000 dataloggers. It includes a rechargeable battery and a regulator.



One end of the #9591 transformer plugs into a wall ac outlet while the other end connects to the PS100 Power Supply.

The BPALK and PS100 are 12 Vdc power supplies for our CR800, CR850, CR1000, CR10X, CR510, or CR500 dataloggers, and peripherals. They can also be used as a separate auxiliary 12-V power supply to power remotely located sensors or peripherals, such as a multiplexer located at a distance from the datalogger enclosure. However, to avoid errors in analog measurements and ground loops, the power supplies must share a common ground.

BPALK Alkaline Power Supply

The BPALK is an alkaline 12-Vdc, 7.5-Ahr power supply that consists of eight replaceable D-cell alkaline batteries, battery connectors, and a temporary 12-V AA battery pack [#8862] used during D-cell replacement. The 8862 requires eight AA-cell batteries (not included).

Alkaline batteries are not rechargeable, and their Amp hour ratings decrease with temperature extremes. Alkaline batteries may leak when used outside the temperature range of -25° to +50°C, or when the battery voltage drops below 9.6 V.

PS100 Rechargeable Power Supply

The PS100 is a 12-Vdc, 7-Ahr rechargeable power supply that consists of a sealed rechargeable battery and a voltage regulator. The regulator controls the current flowing to the battery and prevents the battery current from flowing to the charging source. The sealed rechargeable battery should be trickle-charged via ac power or solar power (see below).

Charging Sources for PS100

Several wall chargers and solar panels are available for recharging the PS100's sealed rechargeable battery. Solar panels charge batteries by converting sunlight into direct current. Wall chargers use power from external ac power lines to recharge the batteries.

Adapters for PS100

Campbell Scientific offers two adapters that fasten onto our PS100 power supply. The A100 allows the PS100 to power peripherals and external devices at non-datalogger sites such as repeater stations. The A105 adapter increases the number of 12 V and ground terminals available on the PS100. The A100 and A105 cannot be used at the same time.

Ordering Information

Power Supplies	
BPALK	12 V, 7.5 Ahr Alkaline Battery Pack
PS100	12 V Power Supply with Charging Regulator and 7Ahr Sealed Rechargeable Battery

Adapters for the PS100	
A100	Null Modem Adapter
A105	12 V Terminal Expansion Adapter

Wall Chargers for PS100	
9591	Wall Charger 18 Vac 1.2 A Output, 110 Vac Input, 6 ft Cable
22110	Wall Charger 18 Vac 1.2 A Output, 110 Vac Input, 6 ft Cable for prewired enclosure.
14014	Wall Charger 18 Vdc Output 90 to 264 Vac 47 to 63 Hz Input. Must choose a power cable option (see below).
22111	Wall Charger 18 Vdc Output 90 to 264 Vac 47 to 63 Hz Input for prewired enclosure. Must choose a power cable option (see below).

Power Cable Options for 14014 or 22111 (choose one)	
-NC	No Power Cable
-USC	US Cable
-EUC	Continental European Cable
-UKC	United Kingdom/Ireland Cable
-AUC	Australia/New Zealand Cable
-CNC	China Cable

Solar Panels for PS100	
SP10	10 W Solar Panel with 20 ft Cable
SP10-PW	10 W Solar Panel with 20 ft cable for prewired enclosure
SP20	20 W Solar Panel with 20 ft Cable
SP20-PW	20 W Solar Panel with 20 ft cable for prewired enclosure

Specifications*

BPALK Alkaline Battery Pack

Nominal Rating:	7.5 Ahrs @ 20°C
Batteries:	8 Alkaline D cells (not rechargeable)
Output Voltage:	12 Vdc
Weight:	1.8 kg
Dimensions (including mounts and connectors):	7.1″ x 2.9″ x 3.1″ (18.1 x 7.4 x 8.0 cm)
Operating Temperature:	-25° to +50°C

PS100 Rechargeable Power Supply

Output Voltage:	12 Vdc
Nominal Capacity:	7 Amp hours
Input Voltage (CHG terminals):	15 to 28 VDC or 18 VAC RMS
Battery Connections	
Charging Output Voltage:	Temperature compensated float charge for battery
Temperature Compensation Range:	-40° to +60°C
Max. Charging Current:	1.2 A (allows one SP20 or SP10 to be used)
Power Out (+12 terminals)	
Voltage:	Unregulated 12 V from battery
Temperature Current Limited with 3 A Thermal Fuse:	> 3 A @ < 20°C; 3 A @ 20°C; 2.1A @ 50°C; 1.8 A @ 60°C
Weight:	6.9 lbs (3.1 kg)
Dimensions (including mounts and connectors)	
Height:	4.1″ (10.5 cm)
Width:	7.6″ (19.0 cm)
Depth:	2.8″ (7.0cm)

**Information about calculating power usage is included in our Power Supply Overview brochure and Power Supply application note. Brochures and application notes are available from: www.campbellsci.com*

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SDM-AO4A

Four-Channel Analog-Output Module

CAMPBELL SCIENTIFIC®
WHEN MEASUREMENTS MATTER

The SDM-AO4A provides four independent, continuous, analog outputs for proportional control or driving strip charts. Measured or processed values in the datalogger are scaled to millivolts and transferred to the SDM-AO4A as digital values. The SDM-AO4A then performs a digital to analog conversion and outputs an analog voltage signal. The output voltage level is maintained until it is updated by the datalogger.

Benefits/Features

- ±5 V and 0 to 10 V modes
- Choice of synchronous and sequential operation
- Resolution of 167 µV
- High Accuracy

SDM Operation

The datalogger enables individual modules through an addressing scheme; multiple SDMs (in any combination) can be connected to one datalogger. After a module is enabled, it operates independently of the datalogger until additional commands are received or results are transmitted.

Datalogger Connection

The CABLE5CBL-L is recommended for connecting the module to the datalogger. A 1-ft cable length should be sufficient when both datalogger and SDM-AO4A are housed within an ENC12/14 enclosure; a 2-ft length may be required if the datalogger and SDM-AO4A are housed at opposite ends of an ENC16/18 enclosure.

The cable length should be as short as possible. Typically, the maximum cable length is 20 ft. Contact Campbell Scientific if the length needs to be longer.

Compatible Dataloggers

Our CR800, CR850, CR1000, CR3000, and CR5000 dataloggers support all of the SDM-AO4A's capabilities. Edlog dataloggers only support the ±5 V mode and synchronous operation. Please note that the SDM-AO4A is not compatible with the CR200(X)-series, CR9000(X), CR500, or CR510 dataloggers.

Power Supply

It may be convenient to use the datalogger's batteries to power the SDM-AO4A, but consideration must be given to the SDM-AO4A's continuous current drain (11 mA in ±5 V mode or 21 mA in 10 V mode). The datalogger's alkaline batteries can power one SDM-AO4A for less than a month, and therefore these batteries are not recommended for continuous long-term operation. The datalogger's sealed rechargeable batteries, float charged by an ac supply or solar panel, typically can be used for long-term operation.

The SDM-AO4A can also be powered from an external 12 Vdc source, independent from the datalogger batteries. The low side of this external 12 Vdc source needs to be connected to datalogger ground and not directly earth grounded.

Ordering Information

Synchronous Device for Measurement	
SDM-AO4A	4-Channel Analog Output Module

SDM-to-Datalogger Cable	
CABLE5CBL-L	5-conductor, 24 AWG cable with drain wire and Santoprene jacket. Enter cable length, in feet, after the -L. Must choose a cable termination option (see below).

Cable Termination Options (choose one)	
-PT	Cable terminates in stripped and tinned leads for direct connection to a datalogger's terminals.
-PW	Cable terminates in connector for attachment to a prewired enclosure.

Specifications

Physical

Operating Temperature: -40° to +60°C

Dimensions: 5.3 x 3.35 x 0.95 in. (13.46 x 8.51 x 2.41 cm)

Weight: 6.2 oz. (175 g)

Analog Output

Voltage Range: ±5 V or 0 to 10 V

Resolution: 167 µV

Accuracy with 20 kOhm load (maximum)

25°C: ±(0.05% of |Vout(V)| + 500 µV)

-40° to 60°C: ±(0.1% of |Vout(V)| + 500 µV)

Additional Full-Scale Error with 50 mA load

±5 V Mode: -1.3 mV typical

0 to 10 V Mode: -1.5 mV typical

Power Requirements

Operating Voltage: 12 Vdc nominal (9.6 V to 16 V)

Typical Current Drain

	±5 V Mode	0 to 10 V Mode
No load, V_{out} =0, V_{supply} = 12 V	11 mA	21 mA
No load, V_{out} =Fullscale, V_{supply} = 12 V	13 mA	28 mA
With load, V_{supply} = 12 V	13 mA + load	28 mA + (2.4)(load)
Power down mode, V_{supply} = 12 V	1.1 mA	

Maximum Output Current

Per Channel: 50 mA

Total: 100 mA

Overcurrent Shutdown Point: 130 mA ± 15 mA

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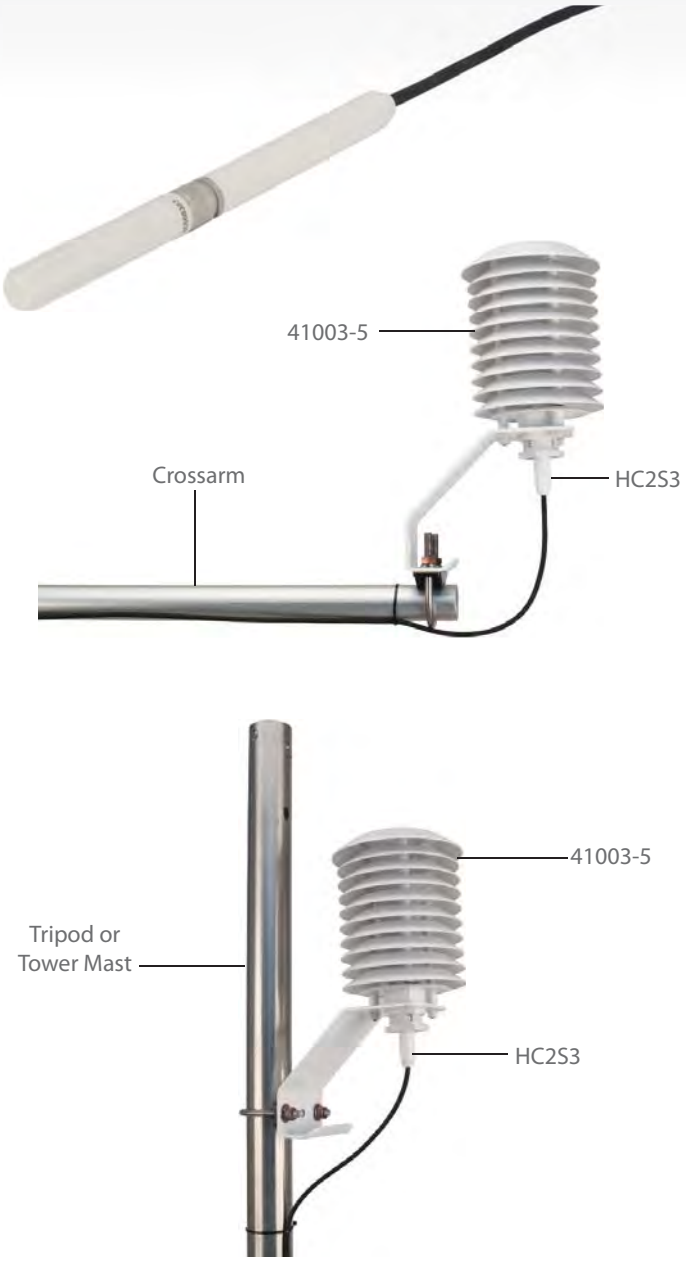
WHEN MEASUREMENTS MATTER

HC2S3

Temperature and RH Sensor

The HC2S3 is a rugged, accurate temperature/RH probe that is ideal for long-term, unattended applications. The probe uses a Rotronic's IN1 capacitive sensor to measure RH and a 100 ohm PRT to measure temperature. For optimum results, the HC2S3 should be recalibrated annually.

The HC2S3 comes with a polyethylene filter that protects its sensor from fine dust and particles and minimizes water absorption and retention. Alternatively, a teflon filter is available for marine environments. The response time is slower when using the teflon filter.



Sensor Mounts

The 41003-5 radiation shield should be used when the HC2S3 is exposed to sunlight. The 41003-5 can attach directly to a mast or tower leg or to a CM202, CM204, or CM206 crossarm.

Ordering Information

Air Temperature and Relative Humidity Probe	
HC2S3-L	Rotronics Temperature/RH Probe with user-specified cable length. Enter cable length, in feet, after the -L. The maximum cable length is 1000 ft. Must choose a cable termination option (see below).

Cable Termination Options (choose one)	
-PT	Cable terminates in stripped and tinned leads for direct connection to a datalogger's terminals.
-PW	Cable terminates in connector for attachment to a prewired enclosure.
-CWS	Cable terminates in a connector for attachment to a CWS900-series interface. Connection to a CWS900-series interface allows this sensor to be used in a wireless sensor network.

Accessories	
41003-5	10-Plate Gill Radiation Shield to house the HC2S3
27755	Teflon Filter for marine environments.

Recommended Cable Lengths

2-m Height		Atop a tripod or tower via a 2-ft crossarm such as the CM202								
Mast/Leg	**CM202**	**CM6**	**CM106**	**CM10**	**CM110**	**CM115**	**CM120**	**UT10**	**UT20**	**UT30**
9 ft	11 ft	11 ft	14 ft	14 ft	14 ft	19 ft	24 ft	14 ft	24 ft	37 ft

Note: *Add two feet to the cable length if mounting the enclosure to the leg base of a CM106, CM110, CM115, or CM120 tripod.*

Specifications

Electronics

Operating Limits:	-40° to +100°C
Storage Temperature:	-50° to +100°C
Dimensions	
Diameter:	15 mm (0.6 in.)
Length:	168 mm (6.6 in.)
Weight:	10 g (0.35 oz)
Filter:	Polyethylene or Teflon
Current Consumption:	<4.5 mA @ 3.3 Vdc <4.3 mA @ 5 Vdc <2.0 mA @ 12 Vdc
Supply Voltage:	5 to 24 Vdc
Maximum Startup Current:	<50 mA for 2 µs

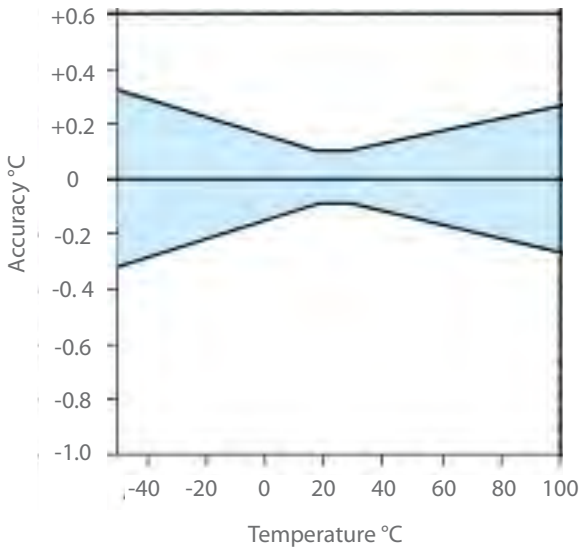
Air Temperature

Temperature Sensor:	PT100 RTD, IEC 751 1/3 Class B
Measurement Range:	-50° to +100°C (default to -40° to +60°C)
Output Signal Range:	0 to 1 V
Long Term Stability:	<0.1°C/year
Sensor Time Constant:	Typical 4 s, 63% step change (1 m/s air flow at sensor)
Temperature Accuracy:	see graph at top right

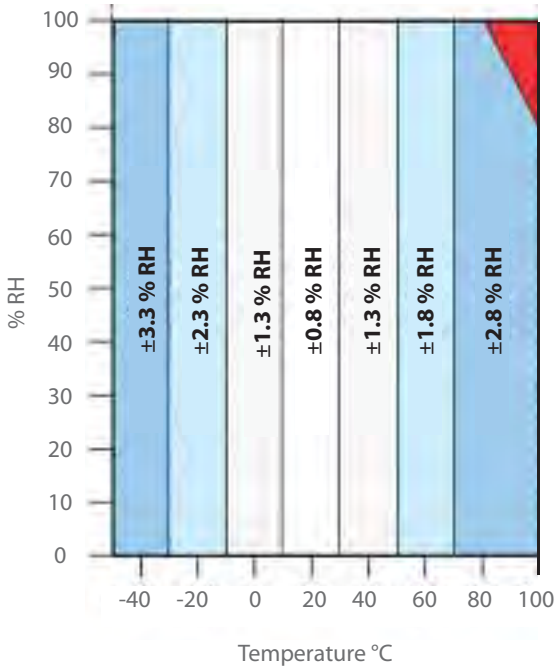
Relative Humidity (RH)

Sensor:	ROTRONIC Hygromer IN-1
Measurement Range:	0 to 100% RH, non-condensing
Output Signal Range:	0 to 1 Vdc
Accuracy at 23°C:	±0.8% RH with standard configuration settings
Long-Term Stability:	<1% RH per year
Response Time:	Typical 10 s, 63% of a 35% to 80% RH step change (1 m/s air flow at sensor)
RH Accuracy over Temperature:	see graph at bottom right

Temperature Accuracy Graph



RH Accuracy Graph



Note: *The black outer jacket of the cable is Santoprene® rubber. This compound was chosen for its resistance to temperature extremes, moisture, and UV degradation. However, this jacket will support combustion in air. It is rated as slow burning when tested according to U.L. 94 H.B. and will pass FMVSS302. Local fire codes may preclude its use inside buildings.*

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October 24, 2011

WindSonic1, WindSonic4

2-D Ultrasonic Anemometers

CAMPBELL SCIENTIFIC®
WHEN MEASUREMENTS MATTER

The WindSonic1 and WindSonic4 are two-dimensional ultrasonic anemometers for measuring wind speed and wind direction. They provide an alternative to traditional mechanical cup and vane or propeller and vane anemometers. Unlike mechanical anemometers, there are no moving parts to be periodically replaced—minimizing routine maintenance costs. These two-dimensional anemometers are manufactured by Gill Instruments, Incorporated.

The WindSonic1 and WindSonic4 differ in their output signal. The WindSonic1 outputs an RS-232 signal that can be read by a CR800, CR850, CR1000, or CR3000 datalogger. The WindSonic4 outputs an SDI-12 signal that can be read by a CR200(X)-series, CR510, CR10X, CR800, CR850, CR1000, CR3000, or CR5000 datalogger.

Mounting

The WindSonic1 and WindSonic4 are shipped with the 17387 mounting kit. This mounting kit is used to attach the sensor to a CM202, CM204, or CM206 crossarm. The crossarm is then mounted to a tripod or tower.

Ordering Information

2-D Ultrasonic Anemometers	
WINDSONIC1-L	Gill 2-D Sonic Wind Sensor with RS-232 Output. Enter cable length, in feet, after the -L (see Maximum Cable Length and Recommended Cable Length sections). Must choose a cable termination option (see below).
WINDSONIC4-L	Gill 2-D Sonic Wind Sensor with SDI-12 Output. Enter cable length, in feet, after the -L (see Maximum Cable Length and Recommended Cable Length sections). Must choose a cable termination option (see below).

Cable Termination Options (choose one)	
-PT	Cable terminates in stripped and tinned leads for direct connection to a datalogger's terminals.
-PW	Cable terminates in connector for attachment to a prewired enclosure.

The WindSonic's minimum detectable wind speed is 0.01 m s^{-1}. The above WindSonic is mounted to a crossarm via the 17387 mounting kit.

Maximum Cable Length

- 50 ft (RS-232 output)
- 300 ft (SDI-12 output with one sensor connected to a single port)
- 200 ft (SDI-12 output with two to ten sensors connected to a single port)

Contact Campbell Scientific if longer cable lengths are required.

Recommended Cable Lengths

CM6	CM106	CM10	CM110	CM115	CM120	UT10	UT20	UT30
10 ft	13 ft	13 ft	13 ft	19 ft	24 ft	13 ft	24 ft	34 ft
These cable lengths assume the sensor is mounted atop the tripod/tower via a CM202 crossarm.								

Specifications

Operating Humidity: 0% to 100% RH

Temperature Range
- **Operating:** -35º to +70ºC
- **Storage:** -40º to +90ºC

Input Voltage: 9 to 30 Vdc

Typical Current Drain
- **WindSonic1:** ~15 mA continuous
- **WindSonic4:** ~23 mA continuous

Measurement Frequency: 40 Hz block averaged to a 1 Hz output frequency

Output Parameters: Polar (direction and speed) or orthogonal (U_x and U_y wind)

Output Signal
- **WindSonic1:** RS-232[1]
- **WindSonic4:** SDI-12 version 1.3[2]

Dimensions
- **Diameter:** 5.6 in (14.2 cm)
- **Length:** 6.3" in (16.0 cm)

Weight: 1.1 lbs (0.5 kg)

Wind Direction

Range: 0º to 360º

Accuracy: ±3º

Resolution: 1º

Wind Speed

Range: 0 to 60 m s^{-1}

Accuracy: ±2% of reading

Resolution: 0.01 m s^{-1}

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[1]For the WindSonic1, the maximum cable capacitance is 2500 pF (50 ft @ 50 pF ft^{-1} or 15.24 m @ 164 pF m^{-1}). For configurations requiring longer cable lengths, contact an applications engineer at Campbell Scientific.

[2]For the WindSonic4, the maximum cable length is 300 ft if one sensor is connected to a single port; the maximum cable length is 200 ft if two to ten sensors are connected to a single port. Contact Campbell Scientific if longer cable lengths are required.

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